TURCK

Industrial Automation

USER MANUAL RFID SYSTEM

SET-UP WITH DeviceNET™

BL ident

S1642/01

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Content

0 About this manual

Introduction 0-2

Preface 0-3

Restrictions 0-3
General Data Alignment 0-3
Gateway Initialization 0-3
Gateway Configuration 0-3
Trademarks 0-3

Description of symbols used 0-4

1 *BL ident* System Components

Reference documentation 1-2
BL ident DeviceNet™ Gateways 1-3
Communication Options 1-3
Summarized Diagnostic Data 1-4
Scheduled Diagnostic Data 1-4
RFID Module 1-5
Transceivers - Read / Write Heads 1-5
Data Carriers - Tags 1-6

2 Gateway Communication Options

EDS file 2-2

Gateway group 2-3
Communication Interface group 2-4
IO data groups 2-4
RFID Module Summary Group 2-5

Poll + COS Data Format 2-6

Poll Connection - Input Data Format 2-6
Poll Connection - Output Data Format 2-7
COS Data Format 2-7

Poll + CIP Generic Data Format 2-9

Poll Connection - Input Data Format 2-9
Poll Connection - Output Data Format 2-10
CIP Generic Data Format 2-10

3 RFID Communication Interface

RFID Command Interface 3-3

Command Codes 3-6

RFID Status Interface 3-8

RFID Full Status Interface 3-8
RFID Reduced Status Interface 3-10
RFID Error Codes 3-10

4 VSC RFID Object

Class Code: 120 (0x78) 4-2

Class Attributes 4-2
Instance Attributes 4-2
Attribute 113 - RFID TAG Produced Data Attribute 4-2
Attribute 114 - RFID TAG Consumed Data 4-3
Common Services 4-4

5 Sequence Diagrams

POLL/COS Diagram 5-2

Poll/COS Tag Read 5-2
Poll Tag Write 5-3

POLL/CIP Diagram 5-4

Poll/CIP Generic Tag Read 5-4
CIP Generic Tag Write 5-4

6 *BL ident* Configuration Procedures

Configuring Poll/COS Communication 6-3

Step 1 - Define Project Requirements 6-3
Step 2 - Assemble and Initialize Gateway 6-6
Step 3 - Configure Gateway Resources 6-7
Step 4 - Download to Gateway 6-8
Step 5 - Upload IO Map 6-9
Step 6 - Configure Scanner 6-10
Step 7 - Map Gateway IO Data 6-11

Configuring Poll/CIP Communication 6-13

Step 1 - Define Project Requirements 6-13
Step 2 - Assemble and Initialize Gateway 6-15
Step 3 - Configure Gateway Resources 6-16
Step 4 - Download to Gateway 6-18
Step 5 - Upload IO Map 6-19
Step 6 - Configure Scanner 6-20
Step 7 - Map Gateway IO Data 6-20

Configure CIP Generic Support 6-22

Step 1 - Configure controller I/O configuration 6-22
Step 2 - Configure "READ_TAG" message 6-22
Step 3 - Configure Receive Tag 6-24
Step 4 - Configure "WRITE_TAG" message 6-25
Step 5 - Configure Transmit Tag 6-26

Managing CIP Data 6-28

7 Appendix

AB Scanner Mapping Resources **7-2**

BL67 Gateway Status Register **7-3**

BL67 Gateway Control Register **7-5**

RFID Command Codes **7-6**

Command codes examples 7-7

RFID Error Codes **7-8**

Warning!
Dangerous electrical voltage!

Before commencing the installation

- Disconnect the power supply of the device.
- Ensure that devices cannot be accidentally restarted.
- Verify isolation from the supply.
- Earth and short circuit.
- Cover or enclose neighbouring units that are live.
- Follow the mounting instructions (AWA) of the device concerned.
- Only suitably qualified personnel in accordance with EN 50 110-1/-2 (VDE 0 105 Part 100) may work on this device/system.
- Before installation and before touching the device ensure that you are free of electrostatic charge.
- The functional earth (FE) must be connected to the protective earth (PE) or to the potential equalisation. The system installer is responsible for implementing this connection.
- Connecting cables and signal lines should be installed so that inductive or capacitive interference do not impair the automation functions.
- Install automation devices and related operating elements in such a way that they are well protected against unintentional operation.
- Suitable safety hardware and software measures should be implemented for the I/O interface so that a line or wire breakage on the signal side does not result in undefined states in the automation devices.
- Ensure a reliable electrical isolation of the low voltage for the 24 volt supply. Only use power supply units complying with IEC 60 364-4-41 (VDE 0 100 Part 410) or HD 384.4.41 S2.
- Deviations of the mains voltage from the rated value must not exceed the tolerance limits given in the specifications, otherwise this may cause malfunction and dangerous operation.
- Emergency stop devices complying with IEC/EN 60 204-1 must be effective in all operating modes of the automation devices. Unlatching the emergency-stop devices must not cause restart.
- Devices that are designed for mounting in housings or control cabinets must only be operated and controlled after they have been installed with the housing closed. Desktop or portable units must only be operated and controlled in enclosed housings.
- Measures should be taken to ensure the proper restart of programs interrupted after a voltage dip or failure. This should not cause dangerous operating states even for a short time. If necessary, emergency-stop devices should be implemented.
- Wherever faults in the automation system may cause damage to persons or property, external measures must be implemented to ensure a safe operating state in the event of a fault or malfunction (for example, by means of separate limit switches, mechanical interlocks etc.).
- The electrical installation must be carried out in accordance with the relevant regulations (e. g. with regard to cable cross-sections, fuses, PE).
- All work relating to transport, installation, commissioning and maintenance must only be carried out by qualified personnel. (IEC 60 364 and HD 384 and national work safety regulations).
- All shrouds and doors must be kept closed during operation.

0 About this manual

Introduction **2**

Preface **3**

Restrictions 3
General Data Alignment 3
Gateway Initialization 3
Gateway Configuration 3
Trademarks 3

Description of symbols used **4**

Introduction

This document introduces the *BL ident* system and its implementation in the DeviceNet™ applications. The document provides subjects from the BL67-GW-DN gateway point of view. All described features are implemented in the same way in the BL20-GWBR-DNET gateway.

Warning

The devices described in this manual must be used only in applications prescribed in this manual or in the respective technical descriptions, and only in connection with components and devices from third party manufacturers that have been certified..

Appropriate transport, storage deployment and mounting as well as careful operating and thorough maintenance guarantee trouble-free and safe operation of these devices..

Warning

It is imperative that all respective safety measures and accident protection guidelines be adhered to.

Restrictions

One command in advance (when a Tag is still not present) is supported.

General Data Alignment

All data alignment is noted to be WORD aligned throughout the document

Gateway Initialization

The gateway has to be initialized the first time it is assembled and upon changing the original IO module structure (adding or removing a module(s), reassembling the node with different IO slot position).

Gateway Configuration

Some applications require downloading the gateway configuration (resources) to the gateway, when its configuration is different from the factory default setup. For example: inclusion of RFID support, diagnostic support (summarized or scheduled), disabling the gateway status or control register. Download is required whenever gateway's configuration is changed.

Trademarks

BL ident ® is registered trademark of TURCK, Inc.
DeviceNet™ is registered trademark of Open DeviceNet Vendor Association.

ControlLogix®, RSNetWorx™ and RSLogix5000™ are registered trademarks of Rockwell Automation.

Description of symbols used

Warning

This sign can be found next to all notes that indicate a source of hazards. This can refer to danger to personnel or damage to the system (hardware and software).

This sign means for the operator: work with extreme caution.

Attention

This sign can be found next to all notes that indicate a potential hazard.

This can refer to possible danger to personnel or damage to the system (hardware and software) and facility.

Note

This sign can be found next to all general notes that supply important information about one or more operating stages.

These specific notes are intended to make operation easier and avoid unnecessary work due to incorrect operation.

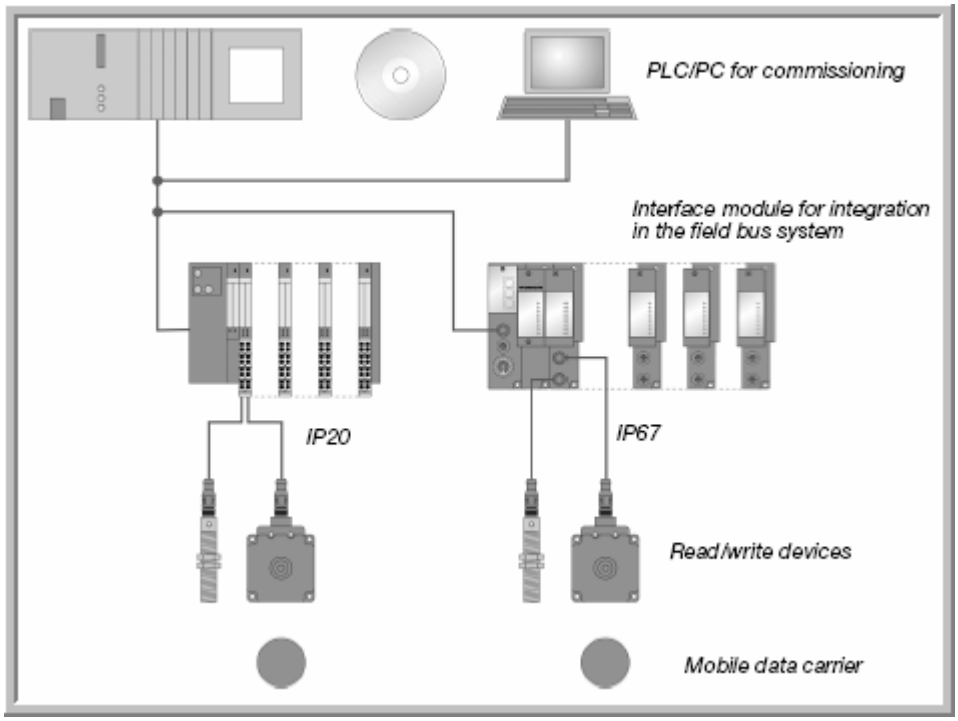
1 *BL ident* System Components

Reference documentation 2
BL ident DeviceNet Gateways 3
Communication Options 3
Summarized Diagnostic Data 4
Scheduled Diagnostic Data 4
RFID Module 5
Transceivers - Read / Write Heads 5
– Transmission frequency 5
– Power consumption 6
– Data transfer rate 6
Data Carriers - Tags 6
– Tag Lifetime Cycle 7

The TURCK *BL ident* system is a radio frequency identification system (RFID) that utilizes the DeviceNet™ communication network for data transmission. In order to meet the requirements of a wide range of different applications, the *BL ident* system, as shown on the Figure 1, provides a variety of options for configuration and selection of:

- DeviceNet™ gateways
- RFID modules
- Transceivers - read/write heads
- Tags - data carriers
- Cordsets

Figure 1:
BL ident system components



Each component is briefly described in the following sections of the document. The features of the BL20 and BL67 gateways and IO modules are provided in the reference documentation at:

http://www.turck-usa.com/Support/Networks/Documentation.htm

Reference documentation

Following publications provide related information and technical description of the system components used by the *BL ident* system:

- *BL ident* Modular RFID System
- BL67 User Manual for DeviceNet
- BL67 IO User Manual
- BL20 User Manual for DeviceNet
- BL20 IO User Manual
- I/O-ASSISTANT - configuration software

BL ident DeviceNet™ Gateways

The BL67-GW-DN and BL20-GW-DN gateways have several new features including:

- Support for multiple and concurrent IO connections: Poll and COS (Change-of-State)
- RFID communication interface built into standard Poll data exchange
- Read RFID data carriers using COS connection
- Write RFID data carriers using Poll connection
- Read / Write RFID data carriers using CIP (Common Industrial Protocol) generic messaging
- Optional error diagnostics of IO modules called "Summarized Diagnostics"
- Optional error diagnostics on a module level called "Scheduled Diagnostics"
- Backward compatibility with previous product releases

The EDS file (Electronic Data Sheet) provides options to select, include or exclude some of the gateway's mapping and IO modules diagnostic data. Along with that, EDS file is used to tailor the RFID IO data map in order to fit scanner's capabilities and allow for optimized RFID data transfer.„AB Scanner Mapping Resources” page 7-2 provides IO mapping resources of the most commonly used scanners.

All these features come with the gateway firmware release:

- Revision 5.006 for the BL67-GW-DNET
- Revision 5.005 for the BL20-GWBR-DNET (Note: BL20-GW-DNET model does not support the RFID)

Communication Options

The DeviceNet™ communication between *BL ident* system and a scanner may be established in two, mutually exclusive ways:

- By using combined Poll and COS connections
- By using combined Poll and Explicit messaging (CIP Generic) connections

The selection of one of methods depends on tag data size and available PLC resources. The following table may be used as reference model:

Table 1: Communi-cation Options

PLC Platform	Data Size	Communication Method	RFID Interface	Read Tag Data	Write Tag Data
SLC-500, PLC-5, All Logix platforms	64 bytes max	Poll + COS connections	Poll	COS	Poll
All Logix platforms	2k bytes max	Poll + CIP Generic connections	Poll	CIP	CIP

Poll connection, in general, is used for exchange of:

- RFID commands and status information
- IO data of all IO modules other then RFID module
- Summarized IO diagnostic
- Scheduled IO diagnostics

Summarized Diagnostic Data

The summarized diagnostic data mode will send back 1 bit for each IO module. This bit will be 0 if there are no diagnostic flags set on the module. Otherwise, it will be set to 1.

Table 2: Summarized diagnostic data

WORD offset	Data	Remark
N + 0	DIAG(0..15)[..]	each bit assigned to a module slot
N + 1	DIAG(16..31)[..]	“
…	DIAG(…)[..]	may be partially filled

Remark: There are as many WORDs allocated as necessary.

- Number of WORDs = (MODULES +15) / 16
- BL67 gateway - 2 words max
- BL20 gateway - 7 words max

Scheduled Diagnostic Data

The scheduled diagnostic data map is a time sliced module related data block, which holds diagnostic data of all modules with active diagnostics. The gateway dynamically exchange diagnostic data of each module in a fault state using a round robin mechanism. This diagnostic "window" can visualize a specific module diagnostic data e. g. for approx. 120ms and change over to next active diagnostics afterwards. A "window change" control mechanism is not requested. It is done automatically by the gateway. Scheduled Diagnostics Data length is set according to properties of modules attached.

Table 3: Scheduled diagnostic data

WORD offset	Data	Remark
0	state (bit8-15) / slot number (bit0-7)	
n	DIAG	(may be part. filled)

State:
acc. Gateway Class, Attr. 116 (bit 7=empty slot, bit 6=wrong module, bit 5=diagnostic active).

Slot number:

the slot, the module is plugged into that generates diagnostics

DIAG[]:

true modules diagnostics, refer to manual of module. Total number of DIAG[] WORDs is set according maximum diagnostic data of modules in module list. No truncation, no unnecessary large allocation.

RFID Module

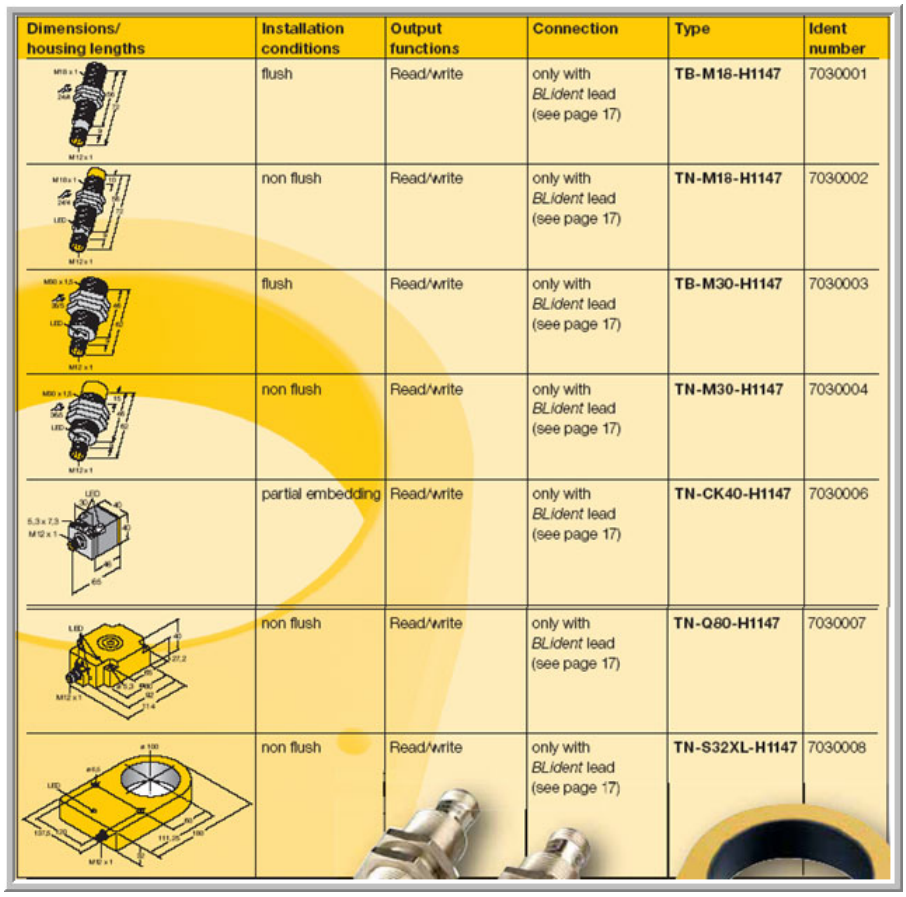
The main features are:

- Node may contain up to 4 modules
- Each module controls two channels
- Each channel operates independently from each other
- The module memory capacity is 16 kB per channel
- Fast microprocessor allows for asynchronous read/write operation
- Data transfer rate between the module and the transceiver is 115.2 kb/s

Transceivers - Read / Write Heads

The *BL ident* system supports following transceivers:

Figure 2: Supported transceivers



Dimensions/ housing lengths	Installation conditions	Output functions	Connection	Type	Ident number
	flush	Read/write	only with *BLident* lead (see page 17)	**TB-M18-H1147**	7030001
	non flush	Read/write	only with *BLident* lead (see page 17)	**TN-M18-H1147**	7030002
	flush	Read/write	only with *BLident* lead (see page 17)	**TB-M30-H1147**	7030003
	non flush	Read/write	only with *BLident* lead (see page 17)	**TN-M30-H1147**	7030004
	partial embedding	Read/write	only with *BLident* lead (see page 17)	**TN-CK40-H1147**	7030006
	non flush	Read/write	only with *BLident* lead (see page 17)	**TN-Q80-H1147**	7030007
	non flush	Read/write	only with *BLident* lead (see page 17)	**TN-S32XL-H1147**	7030008

Transmission frequency

The TURCK *BL ident* system operates at a transmission frequency of 13.56 MHz between the data carrier and the read/write head. This transmission frequency is also employed by the data carriers of so called "Smart Labels", offering good performance at an attractive price. Systems operating at this transmission frequency are largely unaffected by electromagnetic interference.

Power consumption

The average power consumption of the transceiver is 500mA from the DeviceNet™ supply. It may cause considerable power loss down the DeviceNet™ trunk. Consider using power-feeder

BL67-PF-24VDC module to power transceivers from an auxiliary power supply unit.

Data transfer rate

The transceiver data transfer rate depends on the data carrier used in the application. Typical data transfer rate is listed as follows:

Table 4: Scheduled diagnostic data

Data Carrier Type	EEPROM	FRAM	Number of operations	
Read Operation	2 msec/ Byte	0.5 msec/ Byte	Unlimited	
Write Operation	3 msec/ Byte	0.5 msec/ Byte	EEPROM	FRAM
			10^{**5}	10^{**10}

Data Carriers - Tags

The *BL ident* system supports following data carriers:

Figure 3: Tag specification

Dimensions/ housing lengths		Memory size	Memory organization	Operating temperature	Function	Type	Ident number
1	1	128 Byte	EEPROM	-25 ...+85 °C	Read/write	**TW-R16-B128**	6900501
2	2	128 Byte	EEPROM	-25 ...+85 °C	Read/write	**TW-R20-B128**	6900502
3	3	128 Byte	EEPROM	-25 ...+85 °C	Read/write	**TW-R30-B128**	6900503
4	4	128 Byte	EEPROM	-25 ...+85 °C	Read/write	**TW-R50-B128**	6900504
5	5	2 kByte	FRAM	-20 ...+85 °C	Read/write	**TW-R20-K2**	6900505
6	6	2 kByte	FRAM	-20 ...+85 °C	Read/write	**TW-R30-K2**	6900506
7	7	2 kByte	FRAM	-20 ...+85 °C	Read/write	**TW-R50-K2**	6900507
8	8	128 Byte	EEPROM	-40 ...+210 °C	Read/write	**TW-R16-HT-B128**	1542322
8	8	128 Byte	EEPROM	-40 ...+210 °C	Read/write	**TW-R20-HT-B128**	1542324
9	9	64 Byte	EEPROM	-40 ...+210 °C	Read/write	**TW-R22-HT-B64**	1542323
10	10	128 Byte	EEPROM	-40 ...+210 °C	Read/write	**TW-R30-HT-B128**	1542325
10	10	128 Byte	EEPROM	-40 ...+210 °C	Read/write	**TW-R50-HT-B128**	1542326
8	8	2 kByte	FRAM	-40 ...+210 °C	Read/write	**TW-R20-HT-K2**	1542327
10	10	2 kByte	FRAM	-40 ...+210 °C	Read/write	**TW-R30-HT-K2**	1542328
10	10	2 kByte	FRAM	-40 ...+210 °C	Read/write	**TW-R50-HT-K2**	1542329

Tag Lifetime Cycle

The lifetime is determined by the possible read/write operations carried out on the data carrier. FRAM data carriers can guarantee an almost unlimited number (10^{10}) of read and write operations. EEPROM memories can guarantee an unlimited number of read operations and a limited number (10^{5}) of write operations. External batteries for the data carriers are not required.

2 Gateway Communication Options

EDS file 2

Gateway group 3
Communication Interface group 4
IO data groups 4
RFID Module Summary Group 5

Poll + COS Data Format 6

Poll Connection - Input Data Format 6
Poll Connection - Output Data Format 7
COS Data Format 7
– COS message size 8
– COS message sequence counter 8
– COS data flow control 8
– Flag Register 8

Poll + CIP Generic Data Format 9

Poll Connection - Input Data Format 9
Poll Connection - Output Data Format 10
CIP Generic Data Format 10
– Read TAG Request 10
– Read Tag Response 11
– Write TAG Request 11

Following section provides information on the gateway communication interface, IO data mapping and various options that are available for selection. The first step in any project is to define project requirements and configure the internal resources of the gateway. That includes the planning of the gateway communication interface and RFID communication interface.

EDS file

The configuration of the gateway internal resources is a procedure of selecting and downloading to the gateway parameters that determine how the gateway is going to communicate with a scanner card. In that course, the use of the EDS (Electronic Data Sheet) file and a network configuration tool, e.g. RSNetWorx™, becomes essential part of the network configuration process.

The gateway EDS file provides several parameter groups which are used for:

- Selecting gateway interface options through the "Gateway" and "Communication Interface" parameter groupsDownloading the selected features to the gateway
- Resetting the gateway upon which the selected features become initialized and active
- Uploading and verifying that all communication related parameters match specified options

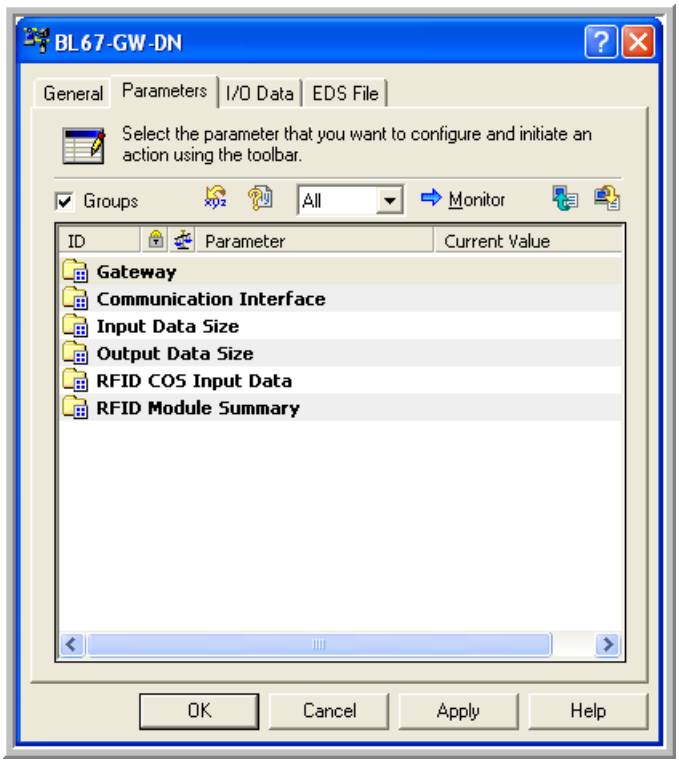
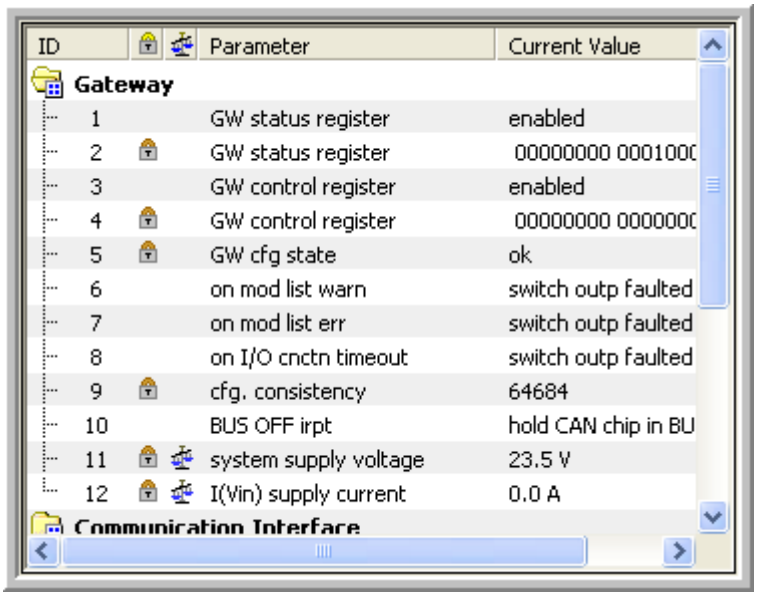


Figure 4: BL ident communication groups

Gateway group

The default factory setup of the "Gateway" group and "Communication Interface" group are shown at figures 5 and 6:

Figure 5: "Gateway" parameter group


ID
Parameter
Current Value
Gateway
1 GW status register enabled
2 GW status register 00000000 0001000
3 GW control register enabled
4 GW control register 00000000 0000000
5 GW cfg state ok
6 on mod list warn switch outp faulted
7 on mod list err switch outp faulted
8 on I/O cnctn timeout switch outp faulted
9 cfg. consistency 64684
10 BUS OFF irpt hold CAN chip in BU
11 system supply voltage 23.5 V
12 I(Vin) supply current 0.0 A
Communication Interface

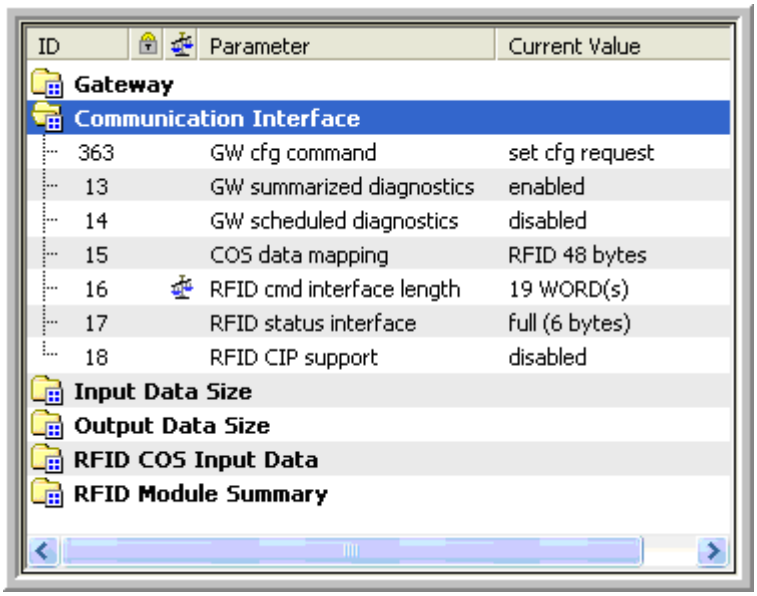
"GW status register" and "GW control register" parameters may be enabled (default setup) or disabled.

IO map is reduced by 1 word when parameter is disabled.

Communication Interface group

The "Communication Interface" group consists of parameters that determine the gateway IO data size and communication properties. The communication property of the gateway is determined by setting the parameter 15 (COS data mapping) or parameter 18 (RFID CIP support). The factory default setup is shown on the following figure:

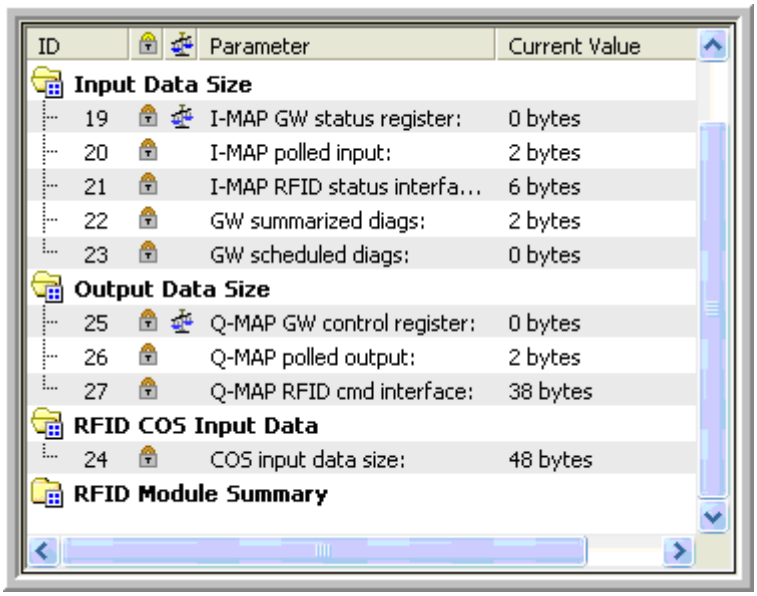
Figure 6: "Communication Interface" parameter group



IO data groups

IO data groups provide read only information on currently selected and allocated gateway resources that are used for the IO data mapping. Figure 7 shows example of the gateway produced and consumed data size and COS input data size when Poll and COS connections are used for data exchange.

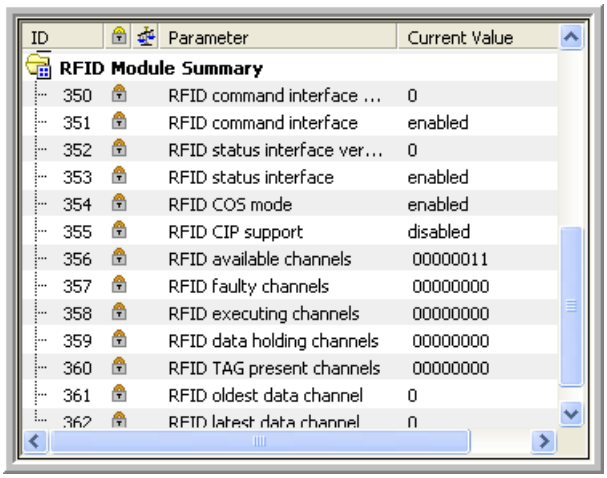
Figure 7: The gateway IO data map


ID
Parameter
Current Value
Input Data Size
19 I-MAP GW status register: 0 bytes
20 I-MAP polled input: 2 bytes
21 I-MAP RFID status interfa... 6 bytes
22 GW summarized diags: 2 bytes
23 GW scheduled diags: 0 bytes
Output Data Size
25 Q-MAP GW control register: 0 bytes
26 Q-MAP polled output: 2 bytes
27 Q-MAP RFID cmd interface: 38 bytes
RFID COS Input Data
24 COS input data size: 48 bytes
RFID Module Summary

RFID Module Summary Group

It shows which RFID features are enabled / disabled and status of the all available channels:

Figure 8: RFID Module Summary


ID
Parameter
Current Value
RFID Module Summary
350 RFID command interface ... 0
351 RFID command interface enabled
352 RFID status interface ver... 0
353 RFID status interface enabled
354 RFID COS mode enabled
355 RFID CIP support disabled
356 RFID available channels 00000011
357 RFID faulty channels 00000000
358 RFID executing channels 00000000
359 RFID data holding channels 00000000
360 RFID TAG present channels 00000000
361 RFID oldest data channel 0
362 RFID latest data channel 0

Poll + COS Data Format

The *BL ident* communication interface utilizes multiple and concurrent connections for data transmission. Poll and COS connections are used to read / write up to 64 bytes of the data. The commands and status information of the RFID channels are exchanged using the Poll connection. The tag data is read using the COS connection. The format of the data is explained in the following sections of the document.

Poll Connection - Input Data Format

The gateway input data (produced data) format consists of the following fields:

Table 5: Input Data Format

Data Length	Field Name	Usage	Default setup	Description
1 word	GW Status Register	Optional	Enabled	Register provides general status of the gateway. Refer to „BL67 Gateway Status Register" page 7-3 for details
Variable	Input IO Data	Conditional	Not applicable	Input data map of non-RFID module(s). GW returns actual data size of the field when IO modules are present =0, when no other IO module is present
Variable	RFID Status Interface	Conditional	Disabled	= 3, words when full RFID interface is selected = 2, words when reduced RFID interface is selected = 0, when RFID module is not present
Variable	Summarized Diagnostics	Optional	Disabled	Provides error status bit for each IO module when enabled. GW returns actual data size of the field
Variable	Scheduled Diagnostics	Optional	Disabled	Provides enhanced module diagnostics when enabled. GW returns actual data size of the field

Poll Connection - Output Data Format

The gateway output data (consumed data) consists of the following fields:

Table 6: Output Data Format

Data Length	Field Name	Usage	Default setup	Description
1 word	GW Control Register	Optional	Enabled	Refer to „BL67 Gateway Control Register" page 7-5 for details. This field is omitted when GW Control Register is disabled.
Variable	IO Output Data	Conditional	Not applicable	Output data map of non-RFID module(s). GW returns actual data size of the field when IO modules are present. =0, when no other IO module is present
Variable	RFID Command Interface	Conditional	Disabled	It consists of two fields: RFID command interface and TAG data. The data size of each field: = 3, words RFID command interface = n, bytes of TAG data to be written where: n= 0,2,..,64 bytes (always even number) Entire field is omitted when RFID module is not used. Tag data field is omitted when "Write" operation is not required or CIP generic is used to "Write" tag data

COS Data Format

The COS Interface provides a fast access to TAG data, keeping in mind, that there is no need for an explicit request like explicit message transfer. Assumed the configuration of the gateway is set to establish a RFID dedicated COS connection, a COS message holds TAG data and additional header info.

Table 7: COS Data Format

WORD address	Data	Remark
Field: Tag Header		
0	COS message sequence counter	Counter is increased with every COS message from gateway (data loss detection)
1	command code / error code	Bit 7-0: command code Bit 15-8: error code
2	channel number / flag register /	Bit 7-0: channel number Bit 15-8: flag register

3	Data start address	TAG data byte offset address
4	Data length	Data byte length
Field: TAG data		
5	TAG data	
…	…	
N	TAG data	may be partially filled

Notes:

- RFID Command codes: „RFID Command Codes” page 7-6
- RFID Error Codes: „RFID Error Codes” page 7-8
- Channel number: { 1..8 }
- Flag register:
  bit0 : 0 = last RFID module data segment
  1 = RFID module indicates follow up segments
  bit1: 0 = last COS data message of response data set
  1 = there are follow up COS data messages available

COS message size

The total length of a COS message cannot be adjusted to current true data length. It must be static. The maximum total length can be configured (in predefined steps) to provide a more or less flexible mapping.

COS message sequence counter

The "COS message sequence counter" is increased with every transmission to indicate that renewed data is available in the scanner.

COS data flow control

Exchange of RFID data using the COS connection must be controlled (handshake). The tag data transmission is initiated from the specified channel when "COS Channel Number" is set in READ command to the respective channel AND the channel is able to provide data (a tag was available and transceiver had read data).

If data is not currently available, transmission of data is delayed until channel data is present. Valid channel values from 1 to 8 will establish a message data contents concerning one (the defined) channel only.

In order to initiate next transmission, the "COS Channel Number" value must be set to a different value.

Setting the "COS Channel Number" to 15 (max) will immediately initiate transmission all available data of all channels once. Data is limited to the maximum COS data transmission size configured. If there isn't any data available, the COS data transmission is deferred. An increased "COS message sequence counter" indicates gateway acknowledge.

Setting the "COS Channel Number" to 0 will immediately release a COS data transmission. An increased "COS message sequence counter" indicates gateway acknowledge but all COS data (except "COS message sequence counter") will be set to 0.

Flag Register

The flag register indicates, that there is more data available, which didn't fit into available single COS message buffer. The transmission of these concluding segments can be initiated as described above. See .„POLL/COS Diagram” page 5-2.

Poll + CIP Generic Data Format

Poll and CIP Generic connections are used to read / write up to 2 kilobytes of data. The transmission of a large amount of data may cause timing-out of IO connections and network failure. For that reason, the data should be transmitted in blocks of 50-100 bytes of data at a time, depending on the throughput of a particular network or system.

The commands and status information of the RFID channels is exchanged using the Poll connection. The tag data is transferred using the explicit unconnected messages. The format of the data is explained in the following sections of the document.

Poll Connection - Input Data Format

The gateway input data (produced data) format consists of the following fields:

Table 8: Input Data Format

Data Length	Field Name	Usage	Default setup	Description
1 word	GW Status Register	Optional	Enabled	Register provides general status of the gateway. Refer to „BL67 Gateway Status Register” page 7-3 for details
Variable	Input IO Data	Conditional	Not applicable	Input data map of non-RFID module(s). GW returns actual data size of the field when IO modules are present =0, when no other IO module is present
Variable	RFID Status Interface	Conditional	Disabled	= 3, words when full RFID interface is selected = 2, words when reduced RFID interface is selected = 0, when RFID module is not present
Variable	Summarized Diagnostics	Optional	Disabled	Provides error status bit for each IO module when enabled. GW returns actual data size of the field
Variable	Scheduled Diagnostics	Optional	Disabled	Provides enhanced module diagnostics when enabled. GW returns actual data size of the field

Poll Connection - Output Data Format

The gateway output data (consumed data) consists of the following fields:

Table 9: Output Data Format

Data Length	Field Name	Usage	Default setup	Description
1 word	GW Control Register	Optional	Enabled	Refer to „BL67 Gateway Control Register" page 7-5 for details. This field is omitted when GW Control Register is disabled.
Variable	IO Output Data	Conditional	Not applicable	Output data map of non-RFID module(s). GW returns actual data size of the field when IO modules are present. =0, when no other IO module is present
3 words	RFID Command Interface	Conditional	Disabled	Refer to „RFID Command Interface" page 3-3 for data format and description. This field is omitted when RFID module is not used.

CIP Generic Data Format

CIP Generic is a part of messaging protocol used by Allen-Bradley's series of ControlLogix line of controllers. It utilizes a message instruction of the RSLogix5000™ instruction set to read and/or write data from/to a destination object using "Unconnected Explicit Messages". The destination object must support an "Unconnected Message Manager" (UCMM) that manages the connection.

Other brands of PLC may use Common Industrial Protocol specification to establish a Connection Based Explicit Message to a destination object.

Both methods utilize "Get_Attribute_Single" (GET) and "Set_Attribute_Single" (SET) services to respectively READ and WRITE data from an object. The destination of an object is determined by "Class", "Instance" and "Attribute" parameters. They define the destination of the target object upon which GET/SET function is performed.

The gateway supports a vendor's specific RFID object (VSC RFID Object) which holds TAG related information.

Read TAG Request

Use the following table to specify CIP Generic message instruction that reads the tag data:

Table 10: Read TAG Request

Service / Data	Code (decimal)	Code (hexadecimal)	Description
GET request	14	0x0E	Get_Attribute_Single request
Class	120	0x0078	RFID Object
Instance	1…8	1…8	Channel {1...8}
Attribute	113	0x0071	Read TAG Data Attribute

Read Tag Response

The gateway responds to "Get_Attribute_Single" request with the following response message:

Table 11: Read Tag Response

WORD address	Data	Remark
TAG Header		
0	command / error code	Bit7-0: command code Bit15-8: error code
1	byte start address	TAG byte data offset address
2	remaining byte length (N)	N=0: no further data segments N>0: there is more data available (N bytes left) which will be issued with concluding read accesses (*)
TAG Data		
3	TAG data	
…	TAG data	
N	TAG data	may be partially filled

Notes:

- RFID Command codes: „RFID Command Codes” page 7-6
- RFID Error Codes: „RFID Error Codes” page 7-8
- (*):Segment data length is native RFID module data length and cannot be modified. (Max. 229 bytes TAG data)

Write TAG Request

Use the following table to specify CIP Generic message instruction that writes the data to the tag:

Table 12: Write TAG Request

Service / data	Code (decimal)	Code (hexadecimal)	Description
SET request	16	0x10	Set_Attribute_Single request
Class	120	0x0078	RFID Object
Instance	1…8	1..8	RFID Channel {1..8}
Attribute	114	0x0072	Write TAG Data Attribute
Data			TAG data array

The format of the data to be written to the tag is:

Table 13: Data to be written

WORD address	Data	Remark
TAG Header		
0	Command / Command version	Bit7-0: command code, ref. „RFID Command Codes" page 7-6 Bit15-8: Not used
1	byte start address	TAG byte data offset address
2	byte length (N) / Tag Data	N=0: no further data segments N>0: there is more data available (N bytes left) which will be issued with concluding read accesses (*)
TAG Data		
3	TAG data	
…	TAG data	
…	TAG data	
…	TAG data	May be partially filled

3 RFID Communication Interface

RFID Command Interface 3

Command Codes 6

RFID Status Interface 8

RFID Full Status Interface 8
RFID Reduced Status Interface 10
RFID Error Codes 10

The RFID communication interface serves as a multiplexer that streamlines data exchange between the PLC and the gateway. The scanner IO data map can hold the tag data read from a single channel only. A single channel is read and/or written only after a certain command is issued. It will take, for example, eight scan cycles to send a "Read" commands to each individual channel. A single command and only one command may be sent in advance to any channel. For example, the read command may be issued in advance while the tag is out of transceiver's range.

RFID Command Interface

The commands to different channels are sent successively, each one identified by the channel number. The data format of the RFID command interface is:

Table 14: Data format

Byte	Bit	Name	Description
0	0	Command code	Identifies the required action. ***Command is executed when 'Command Code' changes from 0 to any other value***. Command related data must be constant and consistent until *status interface bit [Execution channel x]* or *status interface bit [Error channel x] is set.* Exception: *In order to cancel* a pending command, the RESET CHANNEL command must be assigned until *status interface bit* *Execution channel x]* resets and *status interface bit [Error channel x]* resets. Afterwards a new command can be issued immediately. *In order to set a new command* (aborting current) assign the new command instead of RESET CHANNEL Command parameters of *Command Interface* always may be edited safely, if *Status Interface::CmdCodeIndicatorFlag* flag is 0 and *Command Interface::Command Code* is 0.
	1	Command code	
	2	Command code	
	3	Command code	
	4	Command version	Distinguishes current command structure from possible future command structures. (must be set to 0)
	5	Command version	
	6	Command version	
	7	Command version	

Table 14: (Forts.) Data format

Byte	Bit	Name	Description
1	0	Channel number	Indicates the channel to which the command is assigned. Allows for up to 15 channels (1..15), even though the BLXX RFID module shall support only up to 8 channels. Coding: { 1..8 }
	1	Channel number	
	2	Channel number	
	3	Channel number	
	4	COS Channel number	COS Message Multiplexer. Initiates transmission of COS Message of selected channel, if available. COS mapping must be configured to be used for RFID application. Coding: { 1..8 } Changing to { 0 } will release a COS msg containing zeros (except COS Msg Sequence Counter), see COS Mapping Setting { 0xF }, any RFID module data will be released immediately on appearance. (auto mode, restricted use)
	5	COS Channel number	
	6	COS Channel number	
	7	COS Channel number	
2 (*)	0	Address (LSB)	Addresses a byte within the tag memory to which the command shall be executed, e.g. write data to byte 428 (and following) of the tag. Allows addressing for tag memory of up to 64 Kbytes, even though currently the BLXX RFID module shall be compatible with tag memories of only up to 2 Kbytes. Coding: { 0..65535 }
	1	Address	
	2	Address	
	3	Address	
	4	Address	
	5	Address	
	6	Address	
	7	Address	
3(*)	0	Address (MSB)	
	1	Address	
	2	Address	
	3	Address	
	4	Address	
	5	Address	
	6	Address	
	7	Address	

Table 14: (Forts.) Data format

Byte	Bit	Name	Description
4(*)	0	Data length (LSB)	Indicates the length in bytes of the data to which the command refers, e.g. write 128 bytes to the tag. Allows data length of up to 64 Kbytes, even though the amount of data is currently limited by the maximal tag memory of 2 Kbytes. Coding: { 0..65535 }
	1	Data length	
	2	Data length	
	3	Data length	
	4	Data length	
	5	Data length	
	6	Data length	
	7	Data length	
5(*)	0	Data length (MSB)	
	1	Data length	
	2	Data length	
	3	Data length	
	4	Data length	
	5	Data length	
	6	Data length	
	7	Data length	
6-70(*)	0-7	according command: - Tag Write Data or - Tag Fill Data (1. byte)	0, 2, 4,..64 bytes of Tag Write Data. If Tag Fill Command is set, the first byte is used only. Gives the value for the fill command. Allows for fill values in the range of 0-255. Using this polled interface, a single write command is limited to this data size. (max. 64 bytes) =0, when CIP Generic Write is used.

Notes:

(*): Meaning of these bytes depends on defined command.

Command Codes

Table 15: Command Codes

Code	Function	Required Command Interface WORD size	BYTE[..] Data Interpretation	Description
0	<idle state>	1		Idle
1	READ TAG DATA	3	CmdVersCode, Channels, AddrL, AddrH, LengthL, LengthH	Read *LengthL/H* bytes of data from tag starting from *AddrL/H*
2	WRITE TAG DATA	3 +n	CmdVersCode, Channels, AddrL, AddrH, **[** LengthL, LengthH **]** Data[..]	Write *LengthL/H* bytes of data to tag starting from *AddrL/H*. Word *LengthL/H* is not mapped using CIP, resp. Expl. Msgs. Using CIP, the *LengthL/H* is dermined by the total length of the message.
3	ABORT COMMAND	1	CmdVersCode, Channels	Cancel pending command for the indicated channel.
4	RESET CHANNEL	1	CmdVersCode, Channels	Reset tag channel.
5	FILL TAG	4	CmdVersCode, Channels, AddrL, AddrH, LengthL, LengthH FillDataByte	Fill *LengthL/H* bytes of tag data area starting from *AddrL/H* with *FillDataByte*
6	EXTENDED SERVICE PRIMITIVE	2 +n	CmdVersCode, Channels, {SERVICE PRIMITIVE DATA}	Issues native RFID module/ transceiver commands. Detailed knowledge of supported RFID command set and data mapping is required.
7	CLEAR ERRORS	1	CmdVersCode, Channels	Clears error messages.
8 - 15	Reserved			Reserved for future use

Command codes examples:

Table 16: Examples

CHAN-NEL	IDLE	READ TAG	COS TAG	WRITE TAG	ABORT CMD	RESET CHAN-NEL	FILL TAG	CLEAR ERRORS
1	0x0100	0x0101	0x1100	0x0102	0x0103	0x0104	0x0105	0x0107
2	0x0200	0x0201	0x2200	0x0202	0x0203	0x0204	0x0205	
3	0x0300	0x0301	0x3300	0x0302	0x0303	0x0304		
4	0x0400	0x0401	0x4400	0x0402	0x0403			
5	0x0500	0x0501	0x5500	0x0502				
6	0x0600	0x0601	0x6600					
7	0x0700	0x0701						
8	0x0800							

RFID Status Interface

The RFID status information is transmitted with every poll response (BL67 input data). It contains up to six bytes of data called the RFID Status Interface. The status of different channel is sent in successive poll responses.

RFID Full Status Interface

The RFID status data format:

Table 17: Status data

Byte	Bit	Name	Description
0	0	Data avail. channel number	Indicates the RFID channel, which holds data to be read. The channel numbers are indicated in sequence as data appears. That is, the oldest data is indicated. Updated, if READ COMMAND is executed or COS was charged or channel was reset. Coding { 1..8 }
	1	Data avail. channel number	
	2	Data avail. channel number	
	3	Data avail. channel number	
	4	Status version	Distinguishes current status structure from possible future status structures. Coding { 0 }
	5	Status version	
	6	Status version	
	7	CmdCodeIndicatorFlag	Handshake flag: 0=*Command Interface::Command Code* == 0 1=*Command Interface::Command Code* <> 0 This flag may be used to control fast command sequences. Flag follows given command code value. If 0, a subsequent written command code will be accepted and indicated by a raising *CmdCodeIndicatorFlag* flag. Command parameters of *Command Interface* always may be edited safely, if *CmdCodeIndicatorFlag* flag is 0 and *Command Interface::Command Code* is 0.
1	0	Tag present channel 1	Indicates the presence of a tag in the transmission zone. A bit per channel.
	1	Tag present channel 2	
	2	Tag present channel 3	
	3	Tag present channel 4	
	4	Tag present channel 5	
	5	Tag present channel 6	
	6	Tag present channel 7	
	7	Tag present channel 8	

2	0	Execution channel 1	Indicates the command status. Is high if command is currently executed or if a command is in the buffer. Is low if the last command was completed and no new command is stored in the buffer. A bit per channel.
	1	Execution channel 2	
	2	Execution channel 3	
	3	Execution channel 4	
	4	Execution channel 5	
	5	Execution channel 6	
	6	Execution channel 7	
	7	Execution channel 8	
3	0	Error channel 1	Indicates if there has occurred an error. A bit per channel.
	1	Error channel 2	
	2	Error channel 3	
	3	Error channel 4	
	4	Error channel 5	
	5	Error channel 6	
	6	Error channel 7	
	7	Error channel 8	
4	0	Error channel number	Indicates the number of the channel to which the following error code related. Coding: { 1..8 }
	1	Error channel number	
	2	Error channel number	
	3	Error channel number	
	4	Reserved	Reserved for future use.
	5	Reserved	
	6	Reserved	
	7	Reserved	
5	0	Error code	Provides more detailed information regarding an error that has occurred.
	1	Error code	
	2	Error code	
	3	Error code	
	4	Error code	
	5	Error code	
	6	Error code	
	7	Error code	

RFID Reduced Status Interface

The RFID reduced status interface contains the first four byte of data. "Error Codes" and related "Error Channel Number" bytes are omitted.

RFID Error Codes

The gateway provides following error codes:

Table 18: Error codes

Error code	Name	Description
0	OK	No error occurred, idle
1	PROCESSING CMD	A command was issued, accepted and processing is not finished yet. This is not an error, but a busy indication.
2	COMMAND VERSION NOT SUPPORTED	A command version > 0 was defined. Currently version 0 is supported only.
3	CHANNEL ALREADY BUSY	Aborting a command was not finished while a new one is issued.
4	CHANNEL NOT PRESENT	Channel (“module”) is not present. Two channels per module are supported. Four RFID modules max.
5	CHANNEL NOT INITIALIZED	Gateway could not initialize the RFID module state machine. The channel cannot be used. The channels are initialized automatically. If explicit command RESET CHANNEL fails bringing up this error, it might be caused by hardware problems.
6	CHANNEL ACCESS TIMEOUT	RFID channel state machine does not respond. Might be caused by hardware problems.
7	UNKNOWN COMMAND	Command issued is not supported
8	COMMAND EXEC ERROR	Error occurred while processing a command. (E. g., a TAG, brought into reception area, vanished before command could be finished)
9	INSUFFICIENT DATA	The amount of data given is not sufficient to process the command.
10	<reserved>	
11	<reserved>	
12	<reserved>	
13	<reserved>	
14	<reserved>	
15	<reserved>	

4 VSC RFID Object

Class Code: 120 (0x78) 2

Class Attributes 2
Instance Attributes 2
Attribute 113 - RFID TAG Produced Data Attribute 2
Attribute 114 - RFID TAG Consumed Data 3
– Reduced Interface 3
– Read access 3
– Write access 3
Common Services 4

Class Code: 120 (0x78)

The gateway RFID object is vendor's specific object (VSC) and serves as communication interface between a controller and the RFID module. It is used for reading and/or writing the tag data. It supports 8 instances that hold data of respective channels.

Class Attributes

Table 19: Class Attributes

Attribute	Access	Name	Type	Default Value
100 [0x64]	Get	Class Revision	UINT	1
101 [0x65]	Get	Max Instance	USINT	xx
102 [0x66]	Get	# of Instances	USINT	8
103 [0x67]	Get	Max Class Attribute	USINT	103

Instance Attributes

The instances are assigned to the RFID channels - not to the RFID modules. The advantage is that, using CIP Generic, the customer simply can assign the requested RFID channel number (1 through 8) to the DeviceNet instance number (1 through 8).

Table 20: Instance 1…8

Attribute	Access	Name	Type	Default Value
113 [0x71]	Get	RFID Tag Produce Data	Prod Data Structure	„Attribute 113 - RFID TAG Produced Data Attribute” page 4-2
114 [0x72]	Get/Set	RFID Tag Consumed Data	Cons Data Structure	„Attribute 114 - RFID TAG Consumed Data” page 4-3

Attribute 113 - RFID TAG Produced Data Attribute

Contains the data read from the tag of respective RFID channel. It produces the requested data or at least the data, which could be read. The error code provides additional information to evaluate received data. Failures raises the TAG channel error bit placed in the RFID status interface. The data format is:

Table 21: Attribute 113

WORD address	Data	Remark
0	error code / command	Bit15-8: error code Bit7-0: command
1	byte start address	TAG byte data offset address

2	remaining byte length (N)	N=0: no further data segments N>0: there is more data available (N bytes left) which will be issued with concluding read accesses (*)
3	TAG data	
…	TAG data	
N	TAG data	may be partially filled

Notes:

- Command field:Channel Number
- Error Codes: „RFID Error Codes” page 7-8
- Byte Start Address field:Start address
- (*) Segment data length is native RFID module data length and cannot be modified. (Max. 229 bytes TAG data)

Attribute 114 - RFID TAG Consumed Data

Channel related TAG data is written to this attribute when used in conjuction with the CIP Generic write message. The format of the data written to this attribute is:

Table 22: Attribute 114

WORD address	Data	Remark
0	Command code / Command version	command: Bit 0-7 command version: Bit 8-15
1	byte start address	TAG byte data offset address
2	byte length (N) / TAG data	Depends on command issued.
3	TAG data	if any
…	TAG data	..

Reduced Interface

The interface length can be reduced according to the command set used. Minimum lengths are indicated above.

Read access

Reading from this attribute is optional. It provides a read back functionality of last written data. As long as command is active, it may be read back.

Write access

This attribute consumes the data, which shall be written to the tag. Once written, this data is stored until the tag is recognized and accessed. Writing to this attribute with a data width of less than 2 bytes will be refused and raise an error entry to be read accessing the producing attribute. Failures will raise the tag channel related error bit placed in the RFID status interface. In order to abort a processed command, send ABORT command or simply define a new command, which will abort the old and start the new command.

Common Services

Table 23: Common Services

Service Code	Class	Instance	Service Name
14 (0x0E)	Yes	Yes	Get_Attribute_Single
16 (0x10)	No	Yes	Set_Attribute_Single

5 Sequence Diagrams

POLL/COS Diagram 2

Poll/COS Tag Read 2
Poll Tag Write 3

POLL/CIP Diagram 4

Poll/CIP Generic Tag Read 4
CIP Generic Tag Write 4

The following procedures introduce TAG READ and TAG WRITE sequences. The Poll /COS diagram is valid under condition that CIP Generic messaging is not being used. Similarity, CIP diagram is valid as long as Poll/COS connection is not used. A "mixed mode" can be used also. However, if

"CMD: =WR CHN n" or "CMD: =RD CHN n" (Polled Command Interface TAG Read/Write)

is used, the Command Interface cannot be configured to "Stub".

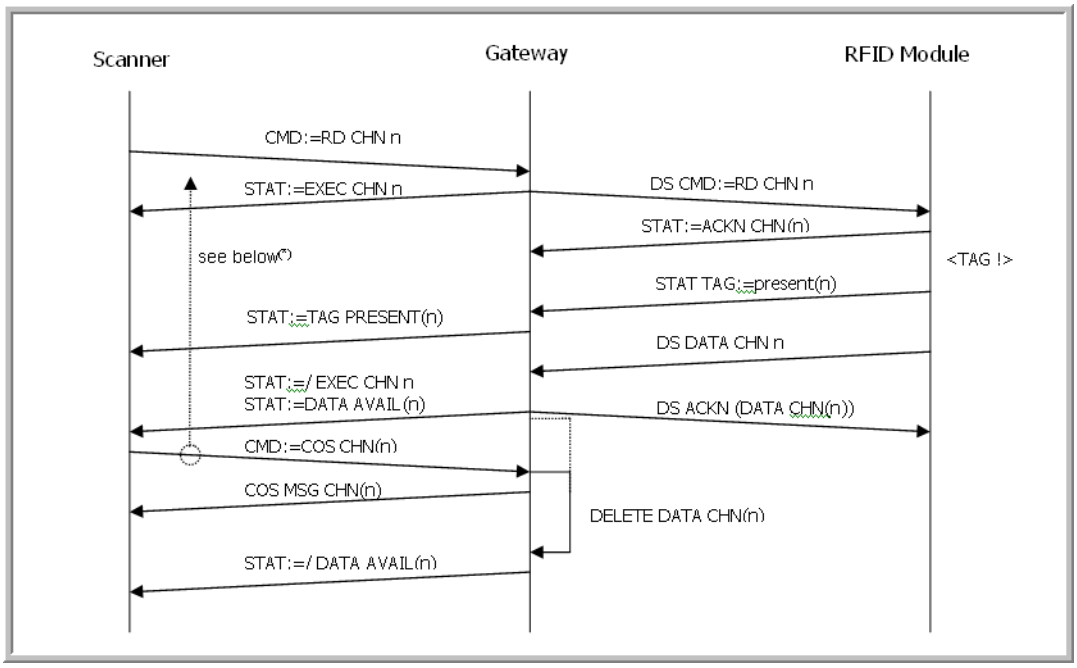
Polled TAG write and TAG read requests while respective EXEC CHN (n) bit of the RFID Status Interface is set raise an error. This is indicated by the Error Channel bit set in the Status Interface. See

POLL/COS Diagram

Poll/COS Tag Read

Following diagram refers to RFID Command Interface and RFID Status Interface. It shows how a physical read could be achieved using polled and COS capabilities.

Figure 9: Physical read

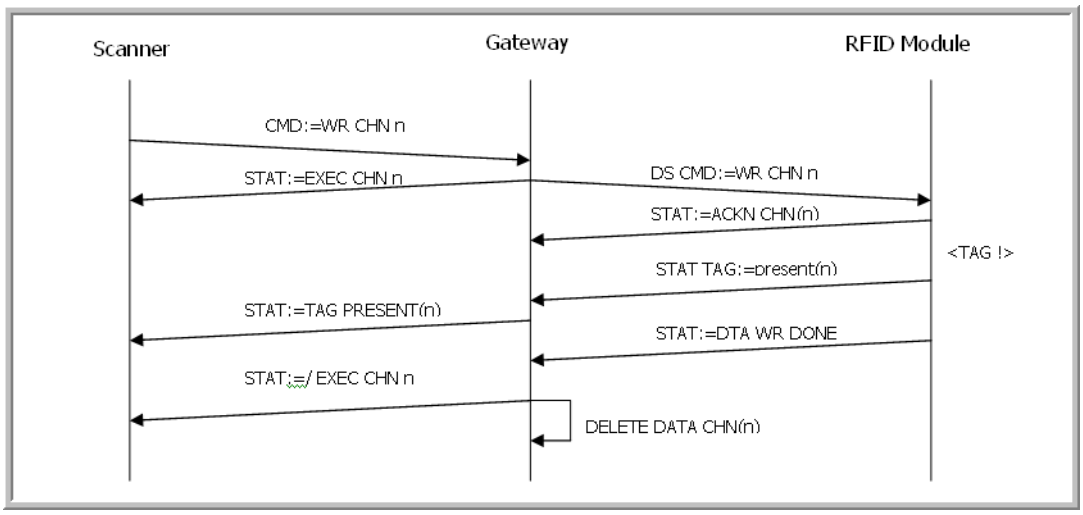


(*): Definition of the COS channel can be done in advance to reduce delay. However, if several channels are accessed (or prepared to be accessed) simultaneously, the COS cannot be defined until DATA AVAIL (n) of respective channel is set by gateway.

Poll Tag Write

The Poll write command sequence is executed as follows:

Figure 10: Poll write command

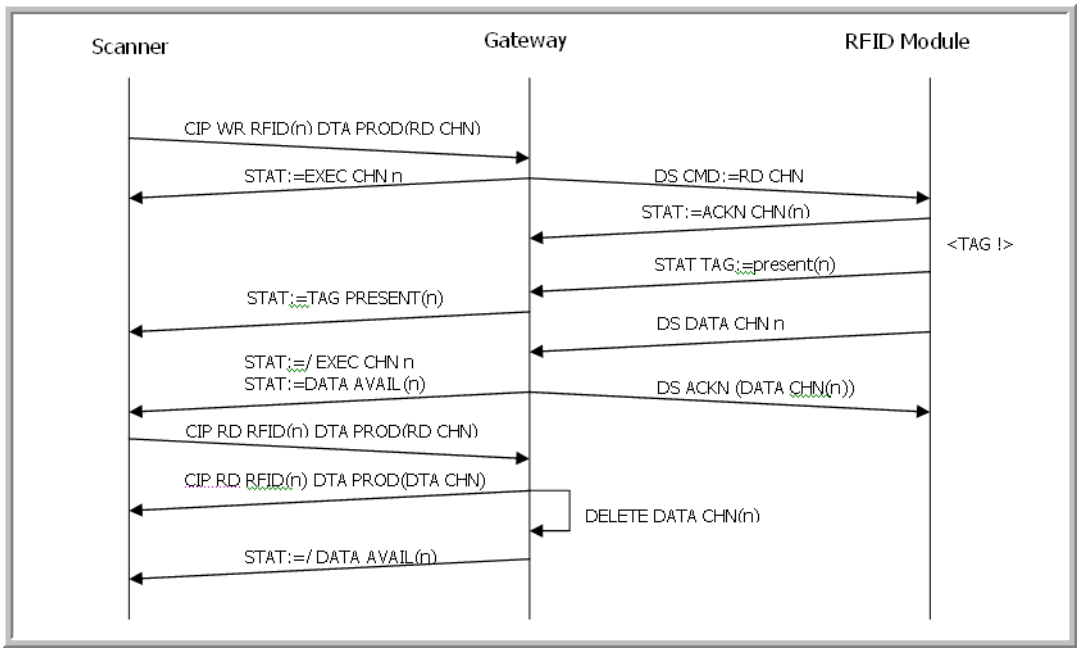


POLL/CIP Diagram

Poll/CIP Generic Tag Read

Following diagram refers to RFID Command Interface and RFID Status Interface. It shows how a physical read could be achieved using polled and CIP Generic capabilities.

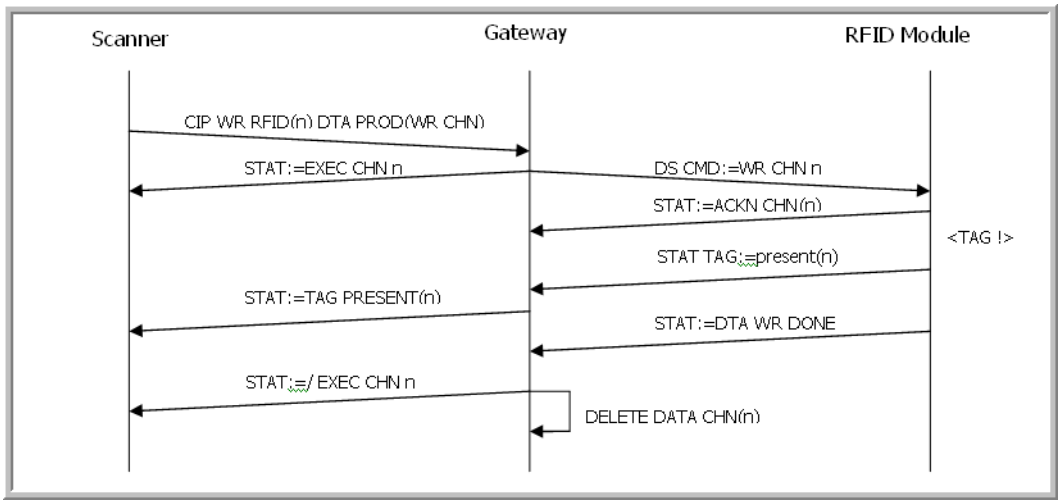
Figure 11: Physical read



CIP Generic Tag Write

Following diagram refers to RFID Command Interface and RFID Status Interface. It shows how a physical write could be achieved using CIP Generic capabilities.

Figure 12: Physical write



6 *BL ident* Configuration Procedures

Configuring Poll/COS Communication 3

Step 1 - Define Project Requirements 3
– Notes: 4
Step 2 - Assemble and Initialize Gateway 6
Step 3 - Configure Gateway Resources 7
Step 4 - Download to Gateway 8
Step 5 - Upload IO Map 9
Step 6 - Configure Scanner 10
Step 7 - Map Gateway IO Data 11

Configuring Poll/CIP Communication 13

Step 1 - Define Project Requirements 13
– Notes: 14
Step 2 - Assemble and Initialize Gateway 15
Step 3 - Configure Gateway Resources 16
Step 4 - Download to Gateway 18
Step 5 - Upload IO Map 19
Step 6 - Configure Scanner 20
Step 7 - Map Gateway IO Data 20

Configure CIP Generic Support 22

Step 1 - Configure controller I/O configuration 22
Step 2 - Configure "READ_TAG" message 22
Step 3 - Configure Receive Tag 24
Step 4 - Configure "WRITE_TAG" message 25
Step 5 - Configure Transmit Tag 26

Managing CIP Data 28

Following section describes the configuration procedure of the *BL ident* system used in two applications:

1 BL67-GW-DN gateway utilizing Poll and COS communication, where the gateway:

- Performs Read / Write up to 64 bytes of data
- Communicates with SLC-500 platform

2 BL20-GWBR-DNET gateway utilizing Poll and CIP Generic message communication, where the gateway:

- Performs Read / Write of 100 bytes in two block transfers
- Communicates with Logix5000 platform

The configuration of CIP generic Read /Write messages is explained in separate section.

Configuration steps

The gateway configuration is described in the following steps:

1 Define project requirements

2 Assemble and initialize the gateway

3 Configuring the gateway resources

4 Download selected options to the gateway

5 Upload from the gateway the IO map and data size

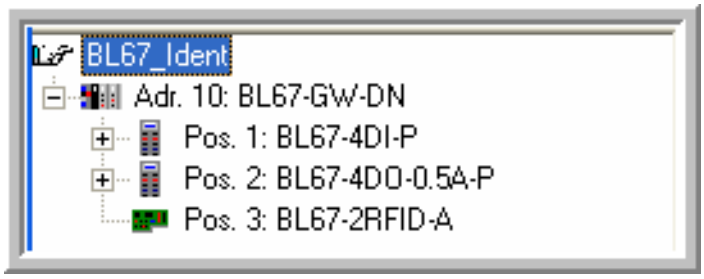
6 Configuring the scanner

7 Map the gateway IO data and download its configuration to the scanner

Step 1 - Define Project Requirements

Controller:	SLC-500
Configuration tool:	RSNetWorx™
Program sample:	Tag1 data is read by channel 1 transceiver and written into tag2 at channel 2.
Tag data size:	32 characters
BL67 node assembly:	

Figure 13: BL67 node assembly



RFID channels:

Table 24: RFID channels

Module #	RFID 1	
Channel #	1	2
Transceivers available	Yes	Yes
Read Data Size (bytes)	32	0
Write Data Size (bytes)	0	32

Gateway setup table:

Table 25: Gateway setup table

GW Resources Setup Table					
Item	**Parameter Group**	**Parameter No**	**Parameter Description**	**Default value**	**Setup value**
1	Gateway	1 [A)]	GW status register	Enabled	Disabled
2		3	GW command register	Enabled	Disabled
3	Communication Interface	363	GW cfg command	Idle	Idle
4		13	GW summarized diagnostics	Disabled	Enabled
5		14	GW scheduled diagnostics	Disabled	Disabled
6		15 [#1]	COS data mapping	Standard (0 bytes)	RFID 48 bytes
7		16 [#2]	RFID command interface	0 WORD(s)	19 WORD(s)
8		17 [#3]	RFID status interface	Disabled (0 bytes)	Full (6 bytes)
9		18	RFID CIP support	Disabled	Disabled

A *The parameter number shows the parameter in the EDS file*

Notes:

#1 - COS data mapping, parameter (15)

The parameter options are:

Table 26: Parameter options

Standard	(Not used with RFID)	n/a
Process Input data	(Not used with RFID)	n/a
RFID 16		16 bytes
RFID 32		32 bytes
RFID 48		48 bytes
RFID 64		64 bytes
RFID 128		128 bytes
RFID 250		250 bytes

Select buffer size that approximately matches the tag data size:

Header = 10 bytes

Data = 32 bytes

Total = 42 bytes → select RFID 48 buffer

#2 - RFID command interface, parameter (16)

The parameter is set to an integer number between 0 - 35 (words) depending of tag data size:

Command interface = 6 bytes

Tag data = 32 bytes

Total = 38 bytes → enter 19 words

#3 - RFID status interface, parameter (17)

The parameter options are:

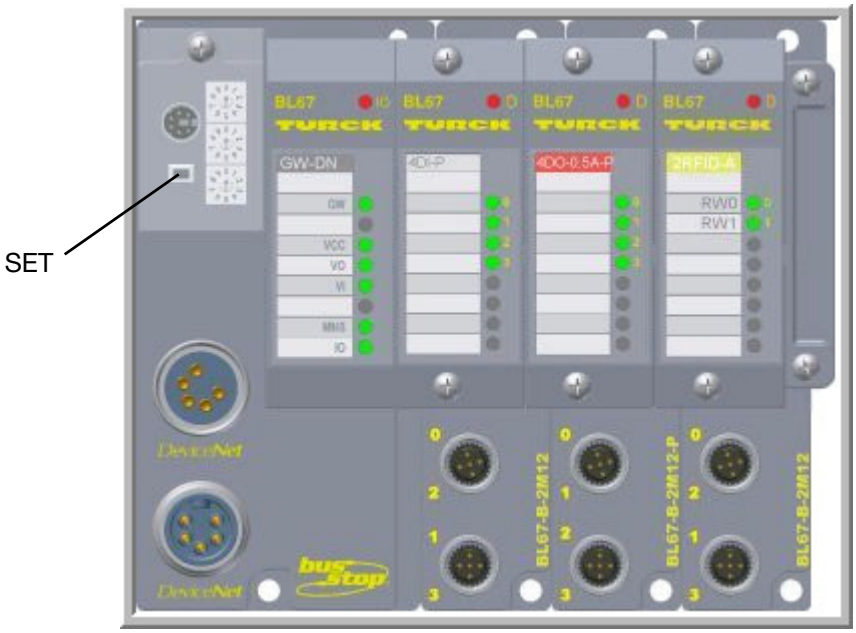
Table 27: Parameter options

Disabled	0 byte
Reduced interface	4 bytes
Full interface	6 bytes

Step 2 - Assemble and Initialize Gateway

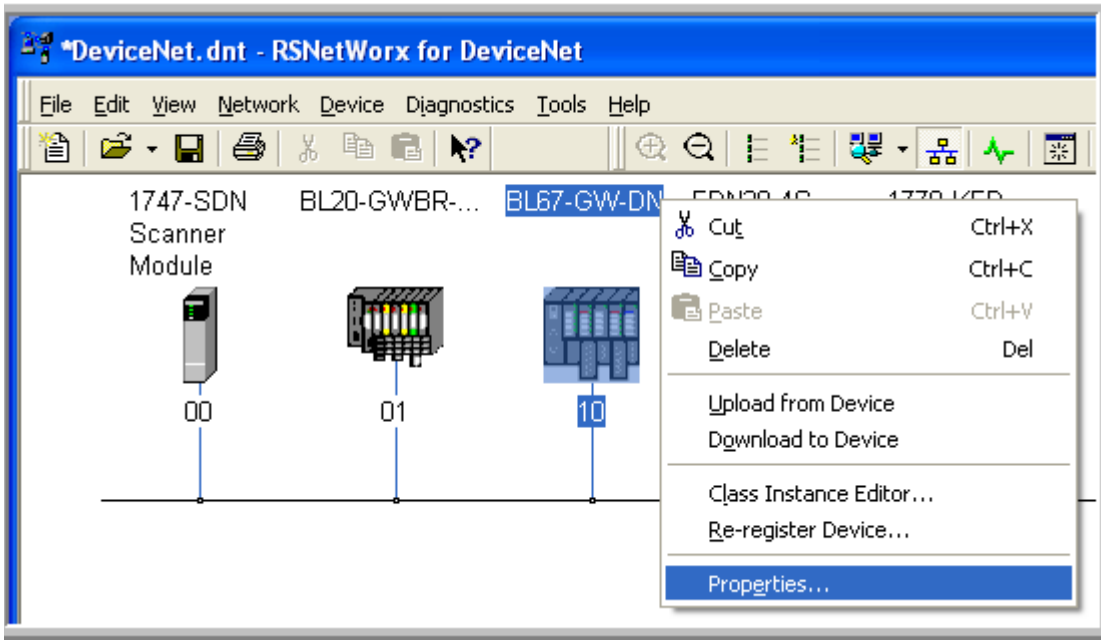
- Assemble and power-up the gateway
- Press and hold "SET" switch for 10 seconds to initialize the gateway. (The gateway must be initialized whenever a module is added or removed.)

Figure 14: Initialize the gateway



- Start RSNetWorx™ and browse network on-line
- Highlight BL67 and select device properties

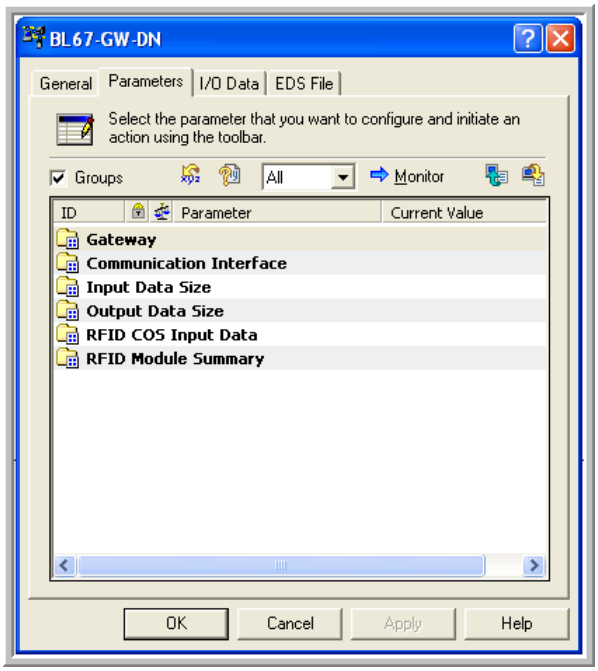
Figure 15: Device properties



Step 3 - Configure Gateway Resources

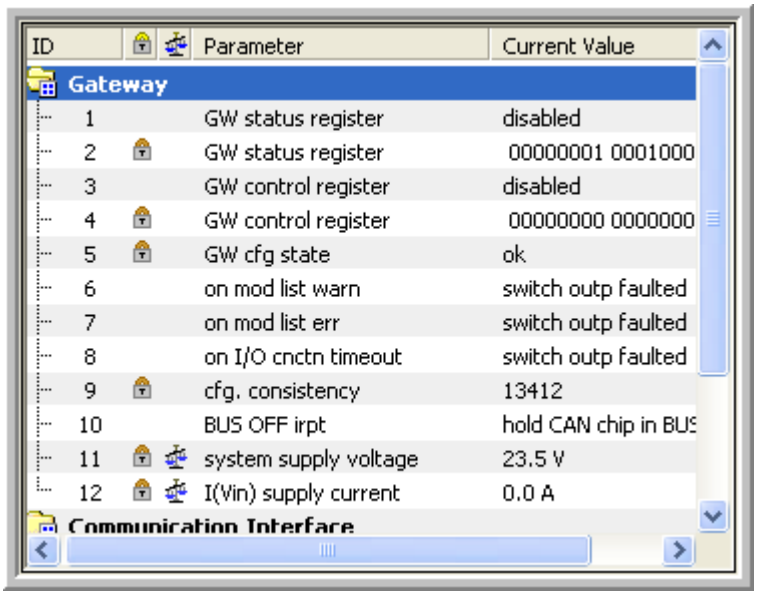
- Select "Parameters" tab and upload all parameters. The parameters show factory default values when uploaded for the first time
- The groups which are related to RFID support are:

Figure 16: Parameter groups



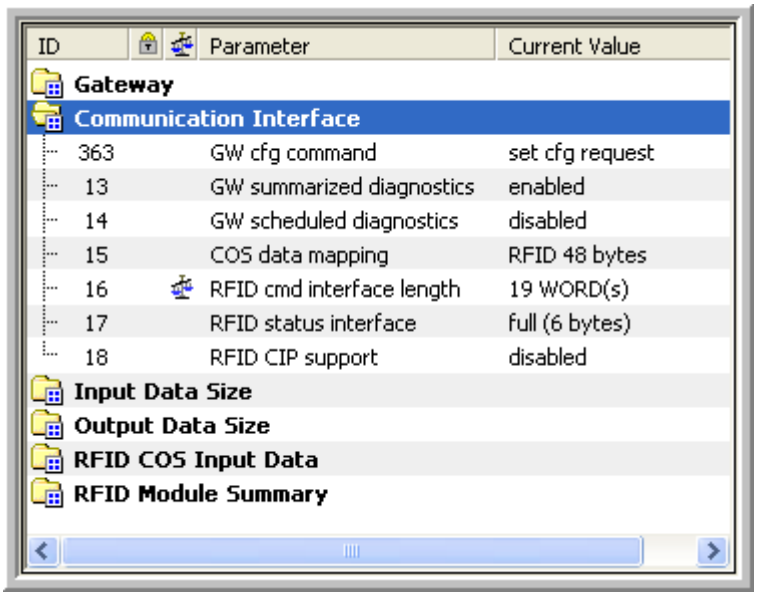
- Expand "Gateway "group and disable parameters 1 and 3. When done, parameters look like:

Figure 17: Gateway group


ID
Parameter
Current Value
Gateway
1 GW status register disabled
2 GW status register 00000001 0001000
3 GW control register disabled
4 GW control register 00000000 0000000
5 GW cfg state ok
6 on mod list warn switch outp faulted
7 on mod list err switch outp faulted
8 on I/O cnctn timeout switch outp faulted
9 cfg. consistency 13412
10 BUS OFF irpt hold CAN chip in BUS
11 system supply voltage 23.5 V
12 I(Vin) supply current 0.0 A
Communication Interface

- Expand "Communication Interface" group and set parameters according to the gateway setup table 1. When done:

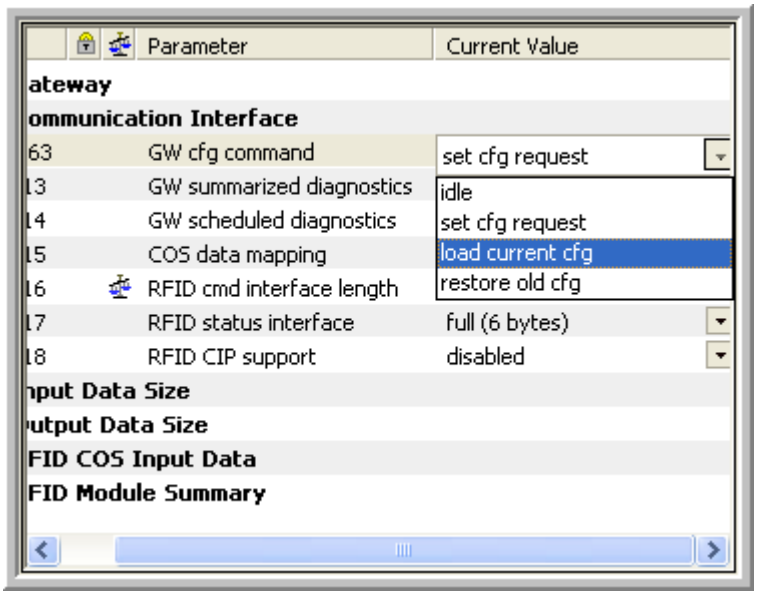
Figure 18: Communication Interface group



Step 4 - Download to Gateway

- Download current configuration to the gateway using "GW cfg command" parameter, option "Load current cfg ":

Figure 19: Download current configuration

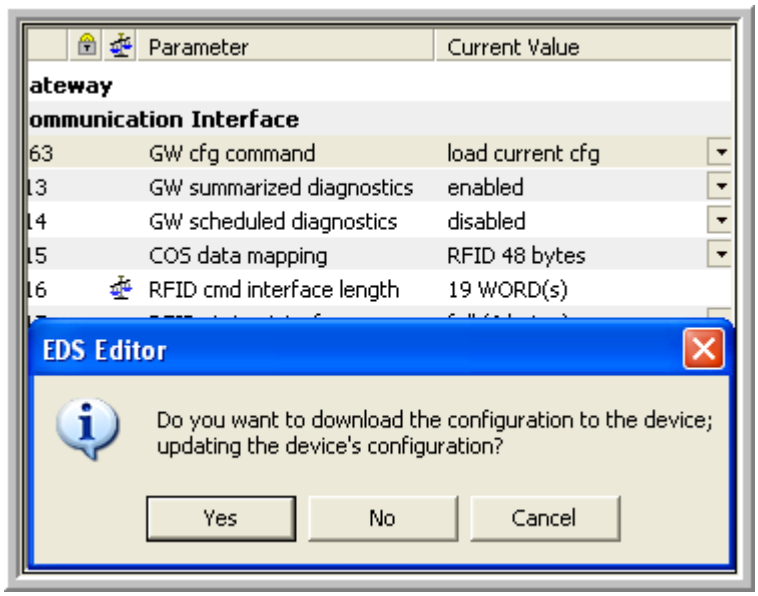


Attention

You HAVE to re-load a new configuration whenever it is changed!

- Press "Apply" and confirm "Yes"
- Gateway will execute "Reset" to save setup permanently

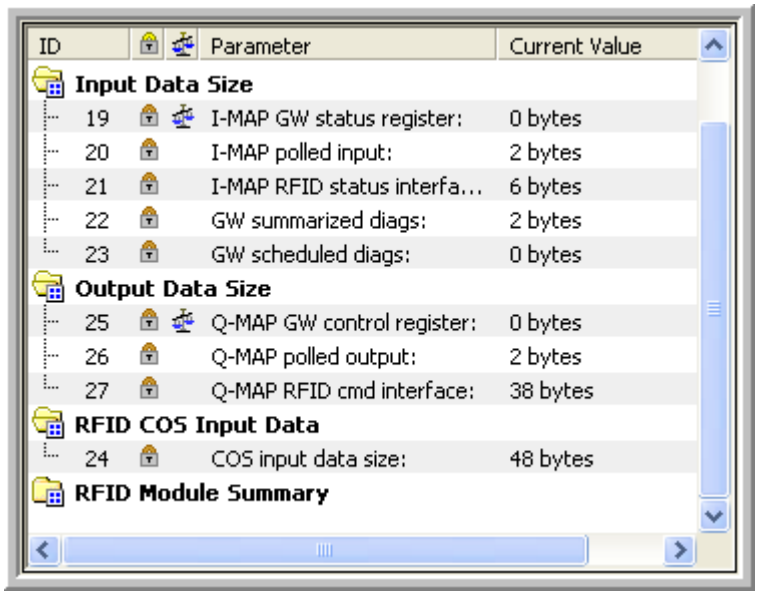
Figure 20: Updating the device's configuration


Parameter
Current Value
ateway
ommunication Interface
63 GW cfg command load current cfg
13 GW summarized diagnostics enabled
14 GW scheduled diagnostics disabled
15 COS data mapping RFID 48 bytes
16 RFID cmd interface length 19 WORD(s)
EDS Editor
Do you want to download the configuration to the device; updating the device's configuration?
Yes
No
Cancel

Step 5 - Upload IO Map

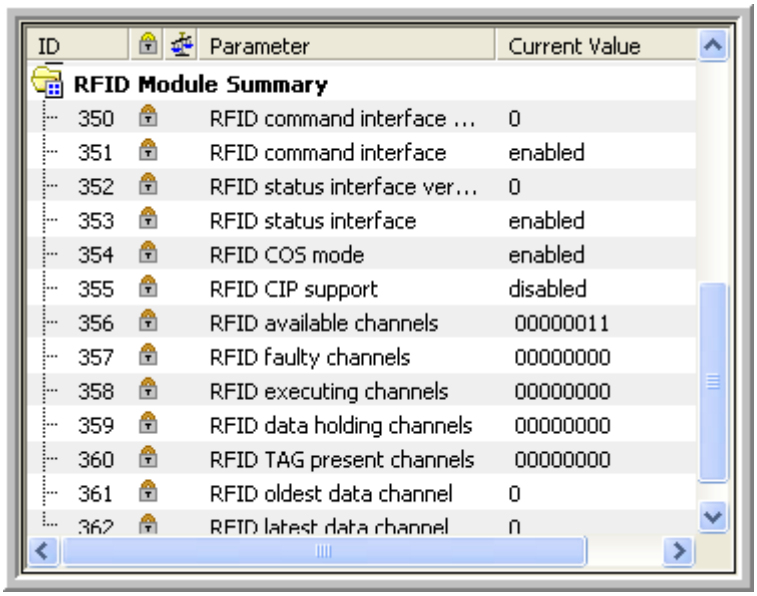
- Upload all parameters after device reset and expand IO groups. The data size of each group is used as input to the scanner configuration:
  - Poll input size = 10 bytes
  - Poll output size = 40 bytes
  - COS input size = 48 bytes

Figure 21: IO groups


ID
Parameter
Current Value
Input Data Size
19 I-MAP GW status register: 0 bytes
20 I-MAP polled input: 2 bytes
21 I-MAP RFID status interfa... 6 bytes
22 GW summarized diags: 2 bytes
23 GW scheduled diags: 0 bytes
Output Data Size
25 Q-MAP GW control register: 0 bytes
26 Q-MAP polled output: 2 bytes
27 Q-MAP RFID cmd interface: 38 bytes
RFID COS Input Data
24 COS input data size: 48 bytes
RFID Module Summary

- Check RFID summary group. It show which RFID features are enabled / disabled and status of the available channels:

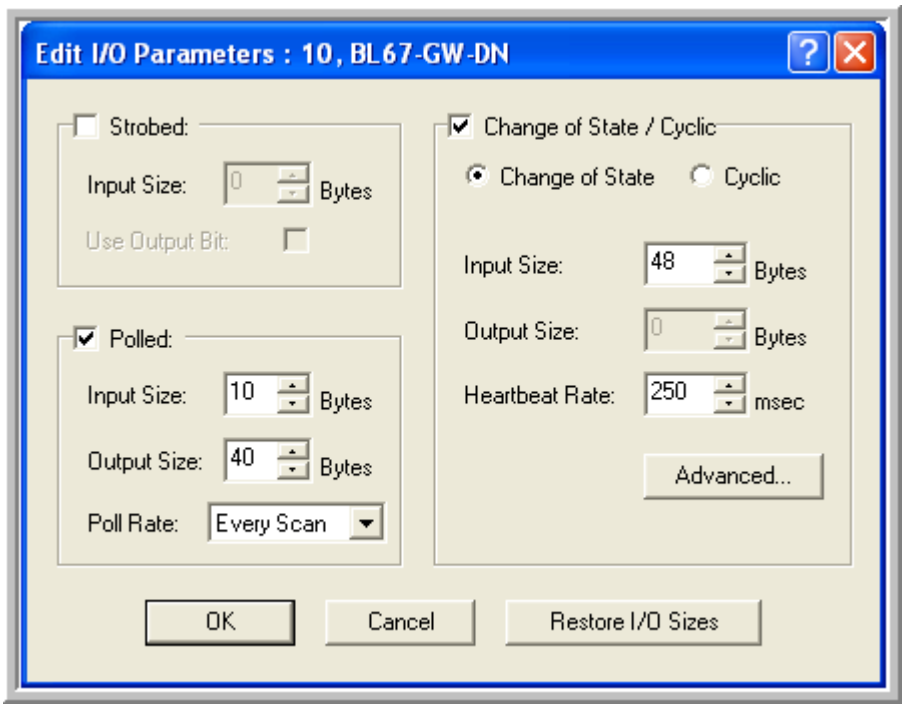
Figure 22: RFID summary group


ID
Parameter
Current Value
RFID Module Summary
350 RFID command interface ... 0
351 RFID command interface enabled
352 RFID status interface ver... 0
353 RFID status interface enabled
354 RFID COS mode enabled
355 RFID CIP support disabled
356 RFID available channels 00000011
357 RFID faulty channels 00000000
358 RFID executing channels 00000000
359 RFID data holding channels 00000000
360 RFID TAG present channels 00000000
361 RFID oldest data channel 0
362 RFID latest data channel 0

Step 6 - Configure Scanner

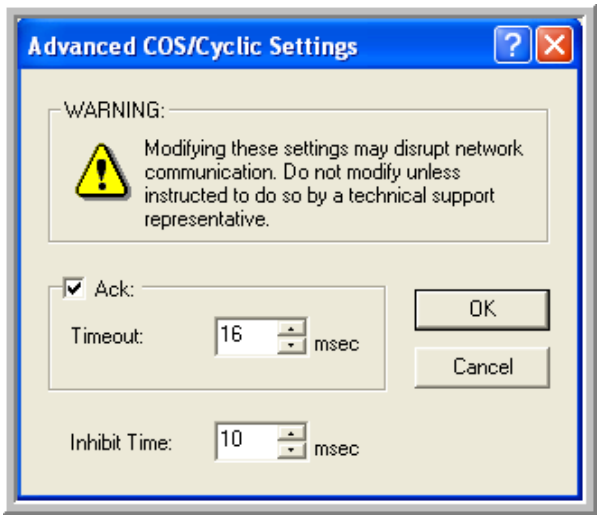
- Enter gateway IO data and set "Heartbeat Rate" between 1000 - 32000 msec depending on the expected communication load of the network:

Figure 23: Set heartbeat rate



- Click "Advanced…" button and set "Inhibit Time" timer to 10msec:

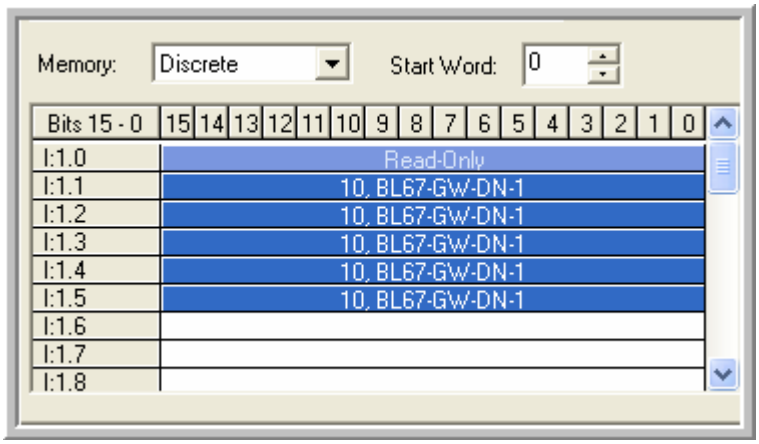
Figure 24:
Set inhibit time



Step 7 - Map Gateway IO Data

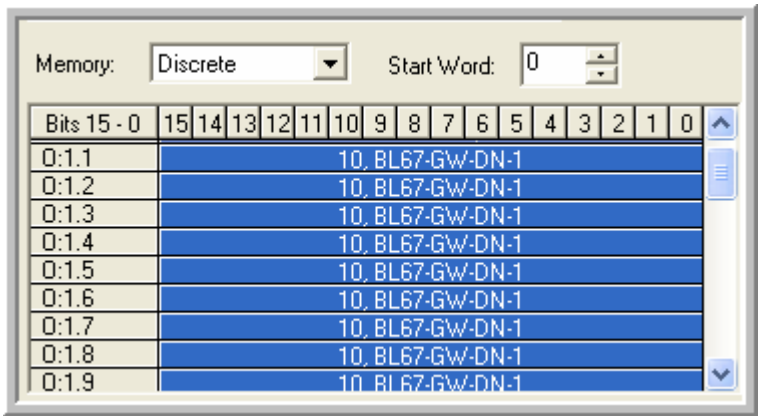
- Map Poll input data into "Discrete" input memory map:

Figure 25:
Map Poll input data



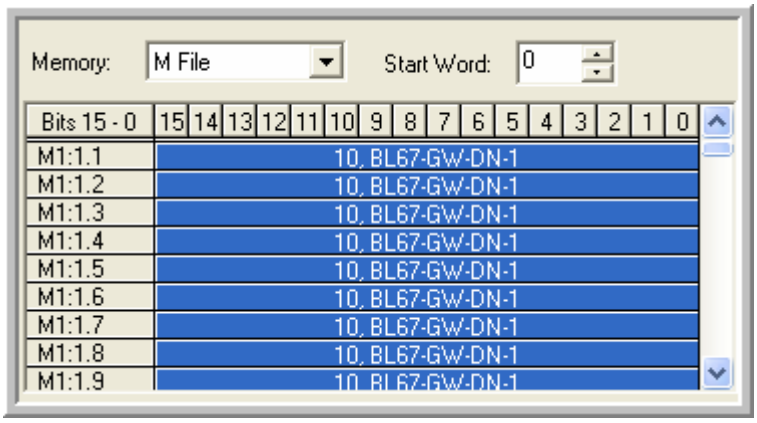
- Map Poll output data into "Discrete" output memory map:

Figure 26:
Map Poll output data



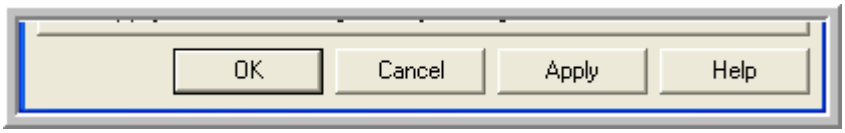
- Map COS input data into "M File" input memory map:

Figure 27: Map COS input data



- Press "Apply" to download gateway configuration to the scanner:

Figure 28: Download gateway configuration to the scanner

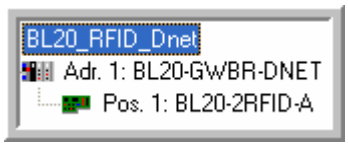


Step 1 - Define Project Requirements

Controller:	ControlLogix™
Configuration tool:	RSNetWorx™
Programming tool:	RSLogx5000™
Program sample:	Data is read in two blocks, each 50 bytes. Each block of data is read by channel 1 and written into tag 2 at channel 2.
Tag data size:	100 characters

BL20 node assembly:

Figure 29: BL20 node assembly



RFID channels:

Table 28: RFID channels

Module #		RFID 1
Channel #	1	2
Transceivers available	Yes	Yes
Read Data Size (bytes)	50	0
Write Data Size (bytes)	0	50

Gateway setup table:

Table 29: Gateway setup table

GW Resources Setup Table					
Item	Parameter Group	Parameter No	Parameter Description	Default value	Setup value
1	Gateway	1[A)]	GW status register	Enabled	Disabled
2		3	GW command register	Enabled	Disabled
3	Communication Interface	397	GW cfg command	Idle	Idle
4		12	GW summarized diagnostics	Disabled	Enabled
5		13	GW scheduled diagnostics	Disabled	Disabled
6		14 [#1]	COS data mapping	Standard (0 bytes)	Standard
7		15 [#2]	RFID command interface	0 WORD(s)	3 WORD(s)
8		16 [#3]	RFID status interface	Disabled (0 bytes)	Full (6 bytes)
9		17	RFID CIP support	Disabled	Enabled

A *The parameter number shows the parameter in the EDS file*

Notes:

#1 - COS data mapping, parameter (14)

The parameter options are:

Table 30: Parameter options

Standard	(Not used with RFID)	n/a
Process Input data	(Not used with RFID)	n/a
RFID 16		16 bytes
RFID 32		32 bytes
RFID 48		48 bytes
RFID 64		64 bytes
RFID 128		128 bytes
RFID 250		250 bytes

Not used - set to "Standard"

#2 - RFID command interface, parameter (15)

The parameter options: an integer number between 0 - 64 (words):

– Command = 6 bytes → enter 3 WORD(s)

#3 - RFID status interface, parameter (16)

The parameter options are:

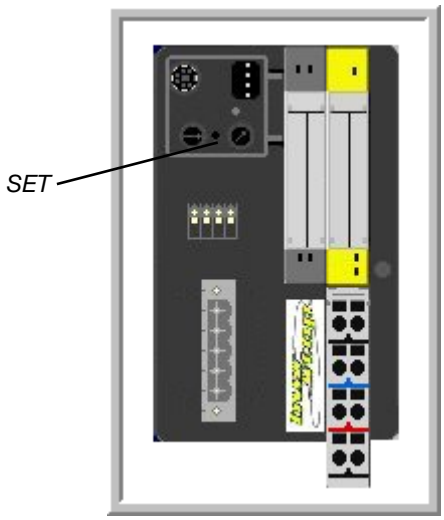
Table 31: Parameter options

Disabled	0 byte
Reduced	4 bytes
Full	6 bytes

Step 2 - Assemble and Initialize Gateway

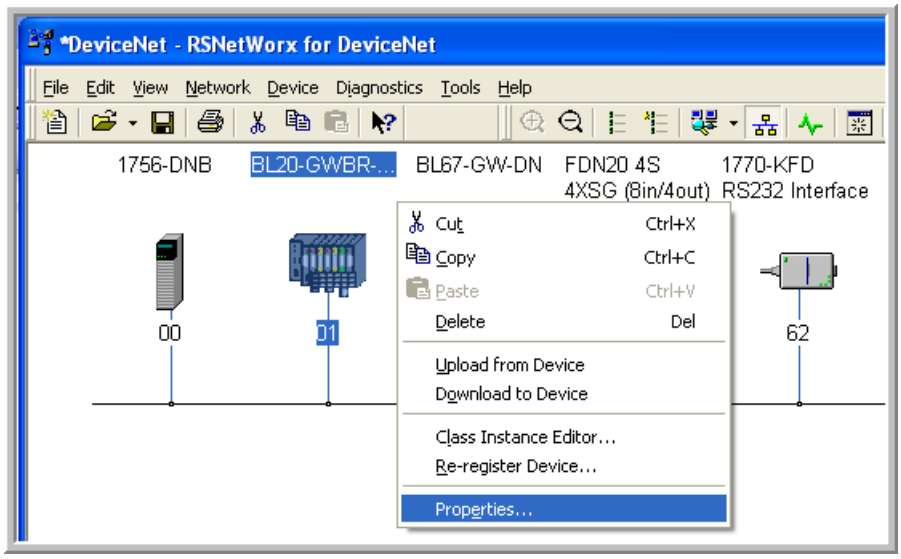
- Assemble and power-up the gateway
- Press and hold "SET" switch for 10 seconds to initialize the gateway. (The gateway must be initialized whenever a module is added or removed.)

Figure 30: Initialize the gateway



- Start RSNetWorx™ and browse network on-line
- Highlight BL20 and select device properties

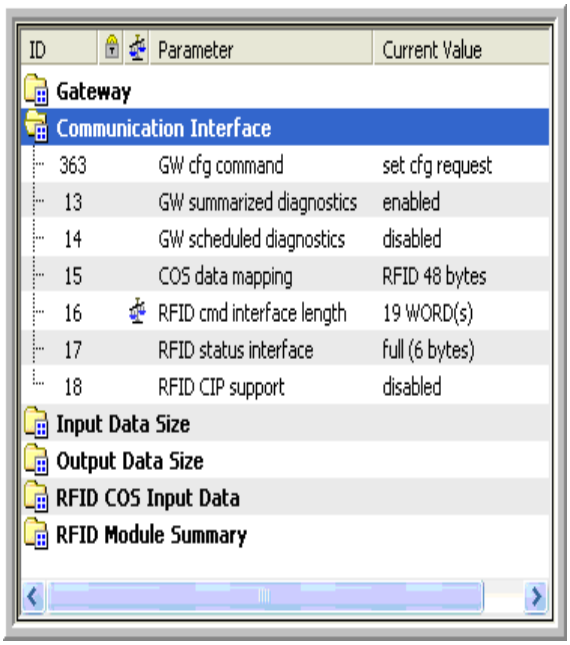
Figure 31: Device properties



Step 3 - Configure Gateway Resources

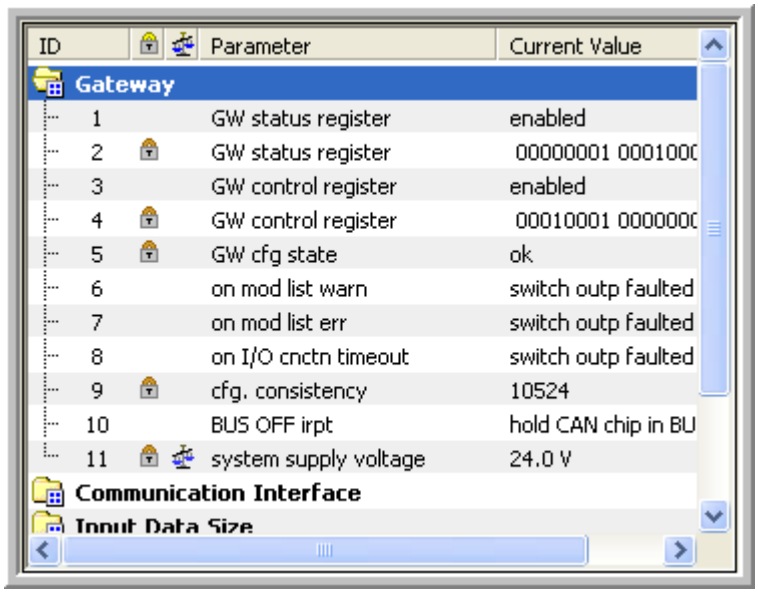
- Select "Parameters" tab and upload all parameters. The parameters show factory default values when uploaded for the first time
- The groups that are related to RFID are:

Figure 32: Configure gateway resources



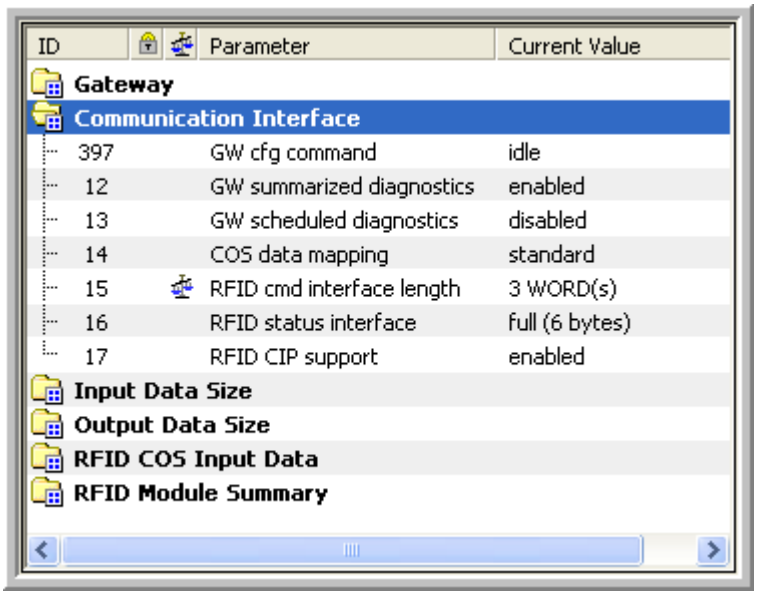
- Expand "Gateway "group and disable parameters 1 and 3:

Figure 33: Gateway group


ID
Parameter
Current Value
Gateway
1 GW status register enabled
2 GW status register 00000001 0001000
3 GW control register enabled
4 GW control register 00010001 0000000
5 GW cfg state ok
6 on mod list warn switch outp faulted
7 on mod list err switch outp faulted
8 on I/O cnctn timeout switch outp faulted
9 cfg. consistency 10524
10 BUS OFF irpt hold CAN chip in BU
11 system supply voltage 24.0 V
Communication Interface
Input Data Size

- Expand "Communication Interface" group and set parameters according to the gateway setup table 2:

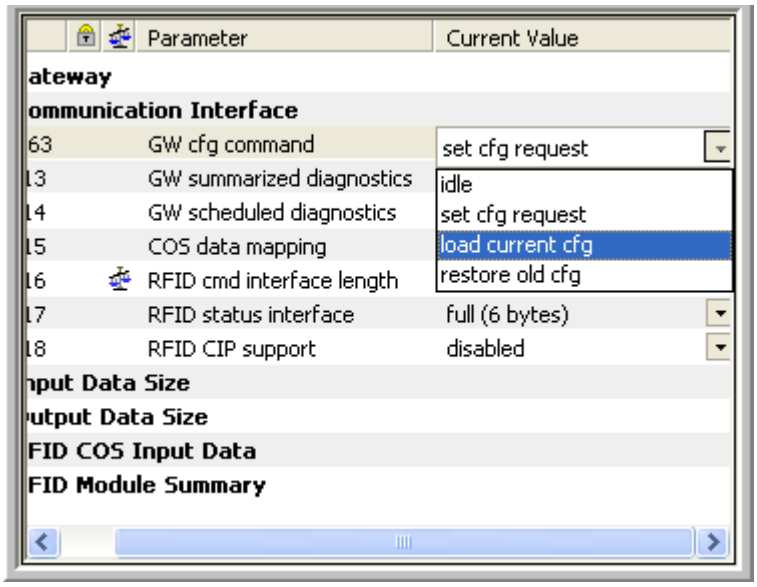
Figure 34: Communication interface group



Step 4 - Download to Gateway

- Download current configuration to the gateway using "GW cfg command" parameter option "Load current cfg ":

Figure 35: Download current configuration

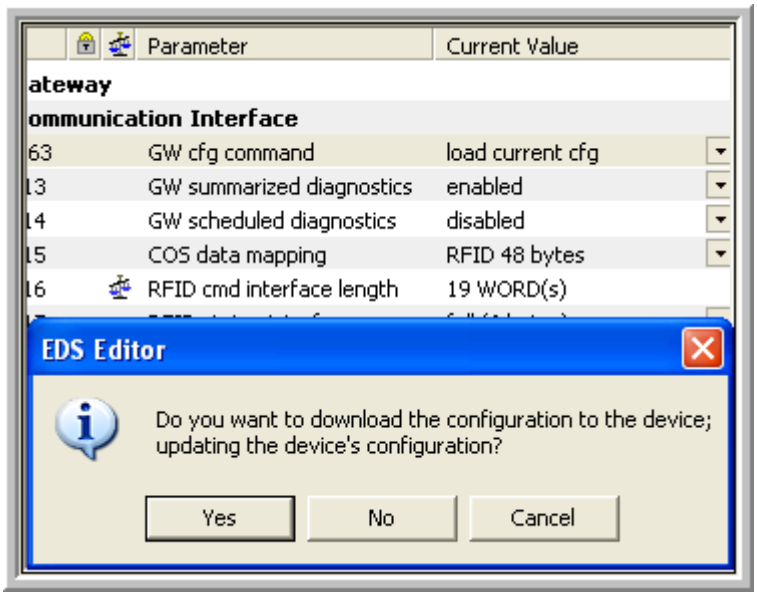


Attention

You HAVE to re-load a new configuration whenever it is changed!

- Press "Apply" and confirm "Yes"
- Gateway will execute "Reset" to save setup permanently

Figure 36: Updating the device's configuration

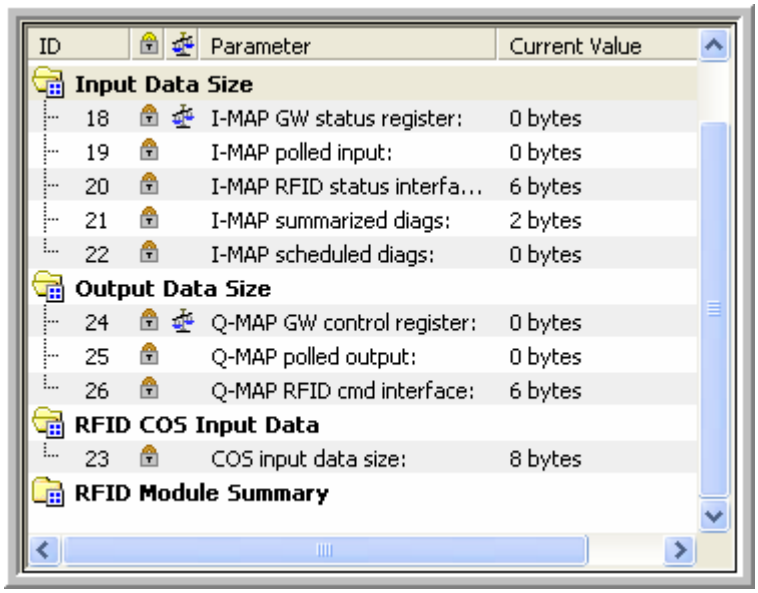


Step 5 - Upload IO Map

Upload all parameters after device reset and expand IO groups. The data size of each group is used as input to the scanner configuration:

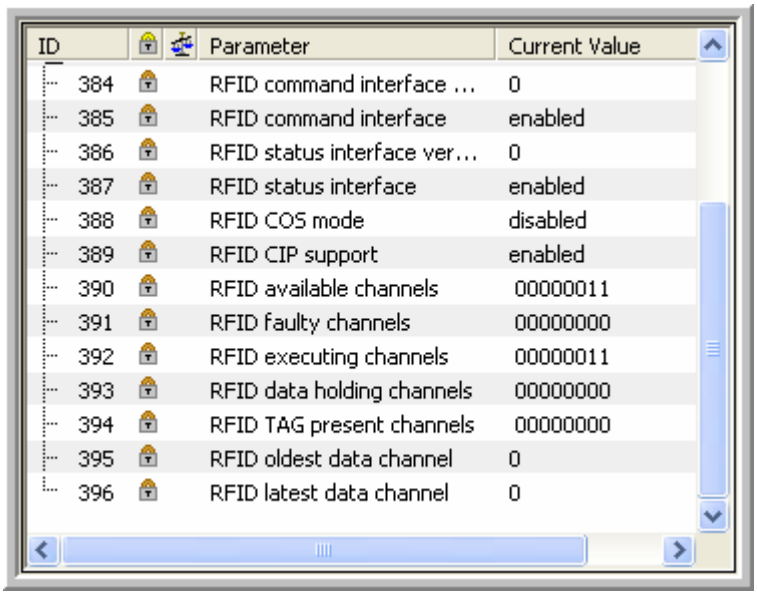
- Poll input size = 8 bytes
- Poll output size = 6 bytes
- DISREGARD COS input size, not to be used

Figure 37: IO groups


ID
Parameter
Current Value
Input Data Size
18 I-MAP GW status register: 0 bytes
19 I-MAP polled input: 0 bytes
20 I-MAP RFID status interfa... 6 bytes
21 I-MAP summarized diags: 2 bytes
22 I-MAP scheduled diags: 0 bytes
Output Data Size
24 Q-MAP GW control register: 0 bytes
25 Q-MAP polled output: 0 bytes
26 Q-MAP RFID cmd interface: 6 bytes
RFID COS Input Data
23 COS input data size: 8 bytes
RFID Module Summary

- Check RFID summary group. It shows which RFID features are enabled / disabled and status of the available channels

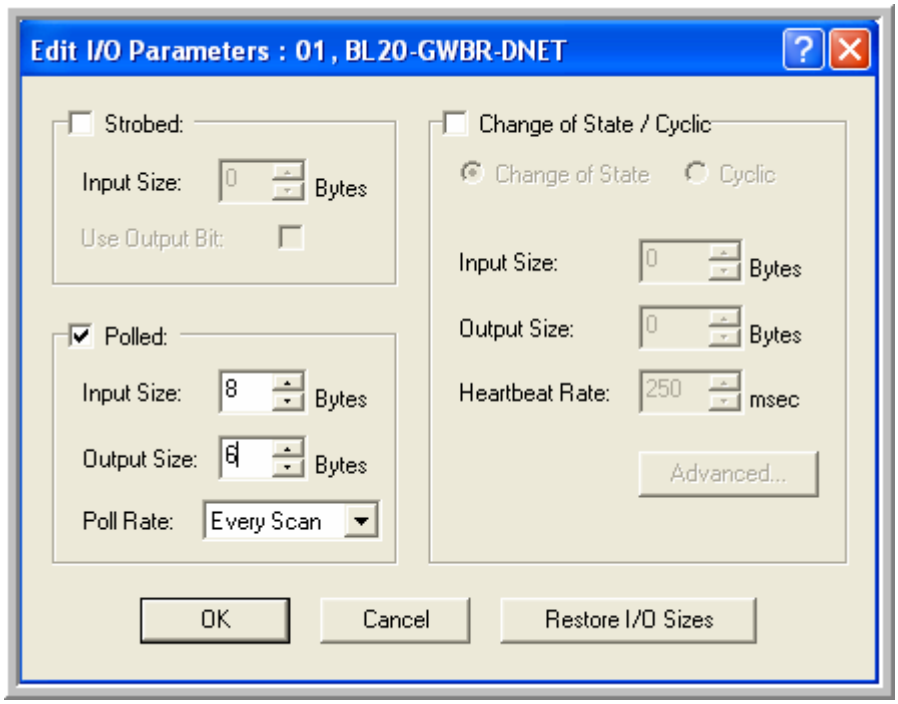
Figure 38: RFID summary group


ID
Parameter
Current Value
384 RFID command interface ... 0
385 RFID command interface enabled
386 RFID status interface ver... 0
387 RFID status interface enabled
388 RFID COS mode disabled
389 RFID CIP support enabled
390 RFID available channels 00000011
391 RFID faulty channels 00000000
392 RFID executing channels 00000011
393 RFID data holding channels 00000000
394 RFID TAG present channels 00000000
395 RFID oldest data channel 0
396 RFID latest data channel 0

Step 6 - Configure Scanner

- Enter gateway IO data:

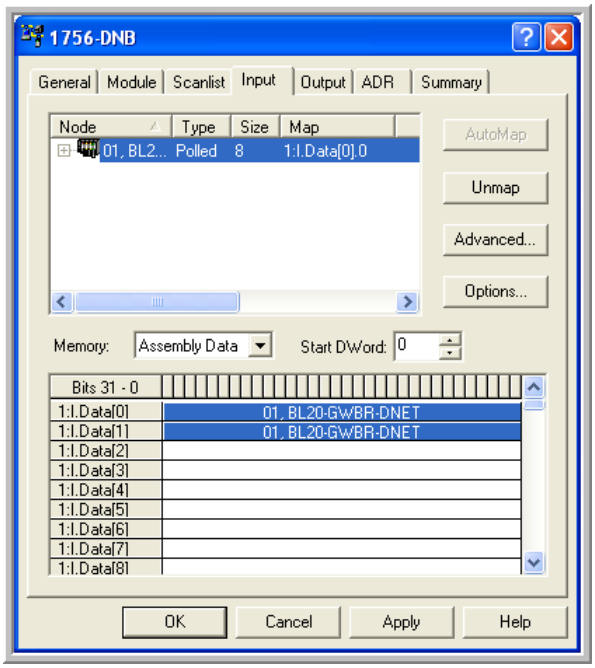
Figure 39: Gateway IO data



Step 7 - Map Gateway IO Data

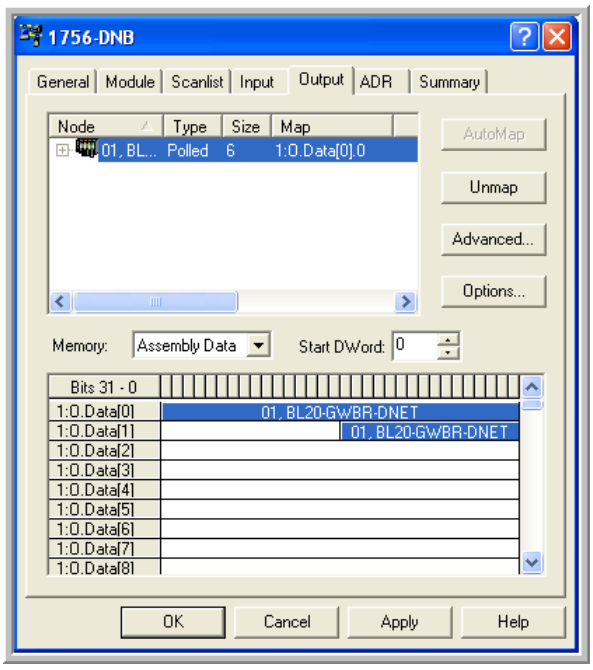
- Map Poll input data into "Discrete" input memory map:

Figure 40: Map Poll input data



- Map Poll output data into "Output Assembly" memory map:

Figure 41: Map Poll output data



Configure CIP Generic Support

The CIP Generic message instructions are used for explicit:

- Reading of RFID tag data
- Writing data to the RFID tag

Each message instruction requires two controller's tags:

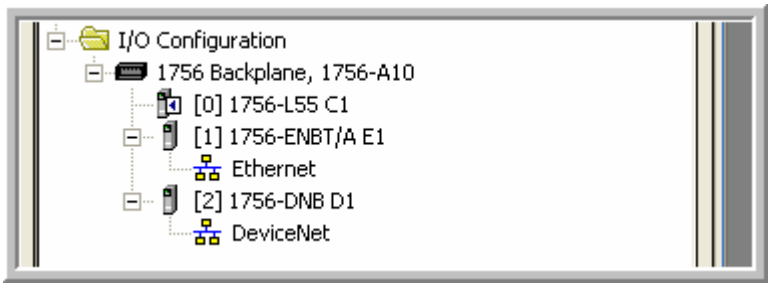
- One that performs the function of a message execution control
- The second one that represent a receive (read data) or transmit (write data) buffer in the controller's memory.

The RFID tag is hereafter referred to as the "data carrier" to make distinction from the controller tag.

Step 1 - Configure controller I/O configuration

- Create RSLogix5000 new project and configure the controller "C1"
- Configure the ContolLogix IO modules "1756-ENBT/A" and 1756-DNB" named as "E1" and "D1".

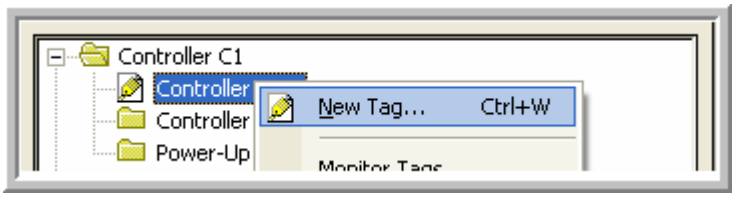
Figure 42: Configure controller I/O configuration



Step 2 - Configure "READ_TAG" message

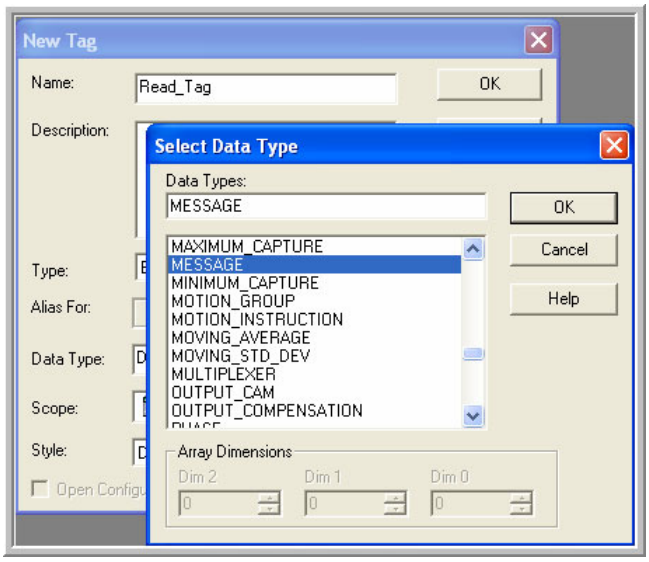
- Create a controller tag associated with Get_Attribute_Single message instruction.

Figure 43: Create a controller tag



- Enter the tag name "Read_Tag", select data type "Message" and Check "Open MESSAGE Configuration" checkbox.

Figure 44: "Open MESSAGE Configuration" checkbox

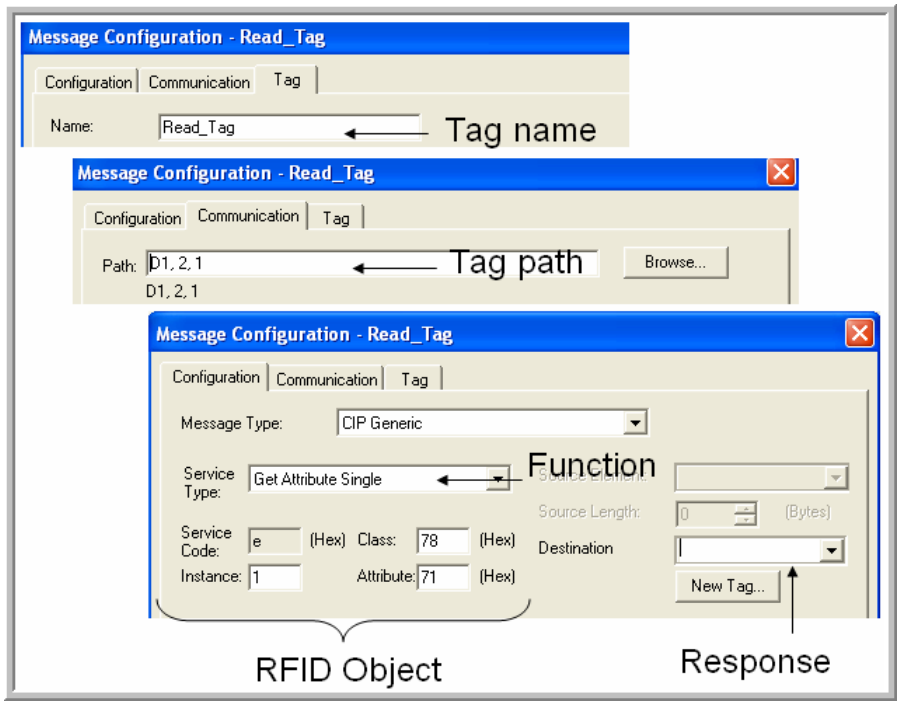


- Enter in the "Communication" page the path of "Read_Tag" as:

  {ScannerID, port, BLxx node address} = {D1, 2, 1}

- Enter in the "Communication" page a target object (Class, Instance, Attribute) of "Get_Attrribute_Single"
  Refer to the „CIP Generic Data Format” page 2-10 for the definition of the RFID Object data.

Figure 45: Message configuration - Read_Tag



Step 3 - Configure Receive Tag

- Enter a new tag "Receive Data" in the "Destination" field where data from the data carrier is stored (receive buffer).

Figure 46:
Receive data

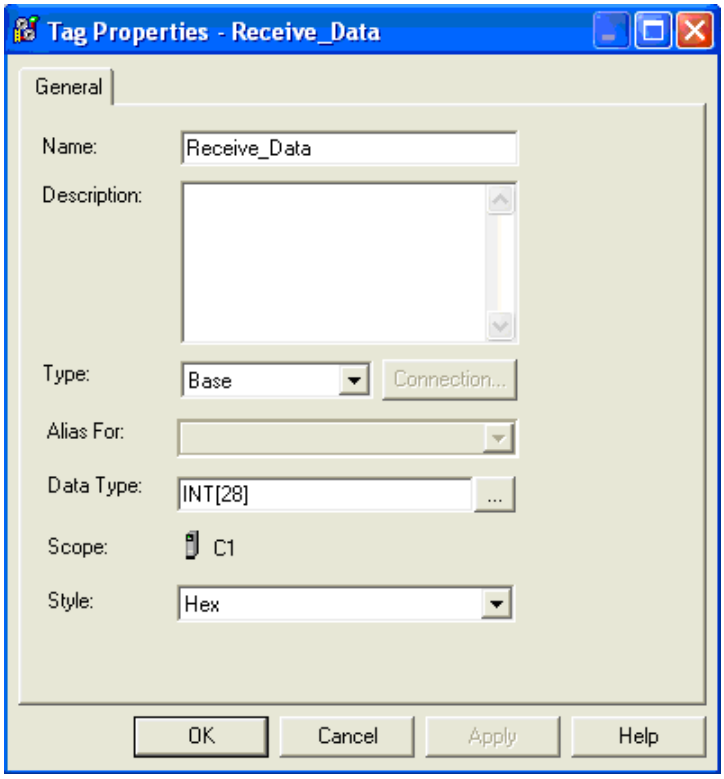
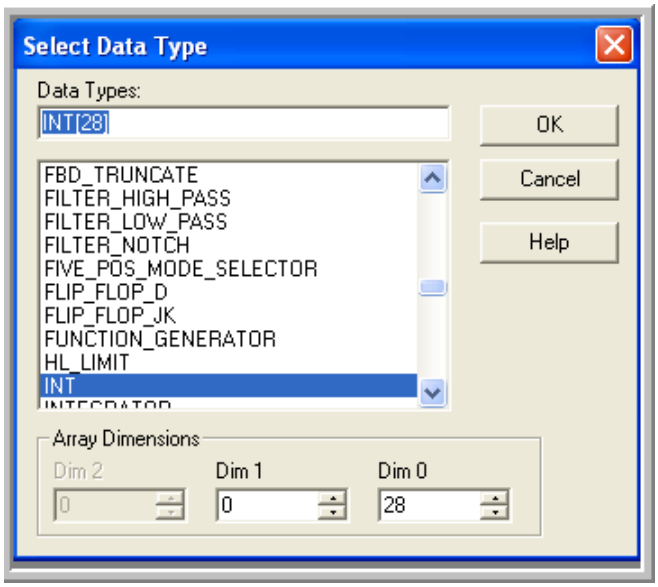


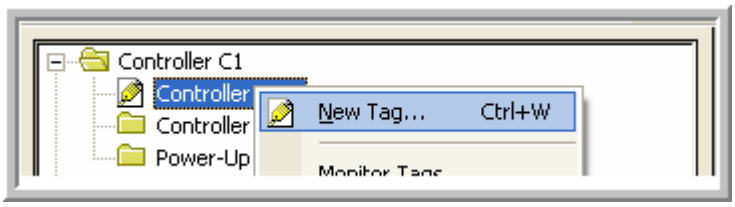
Figure 47:
Select data type



Step 4 - Configure "WRITE_TAG" message

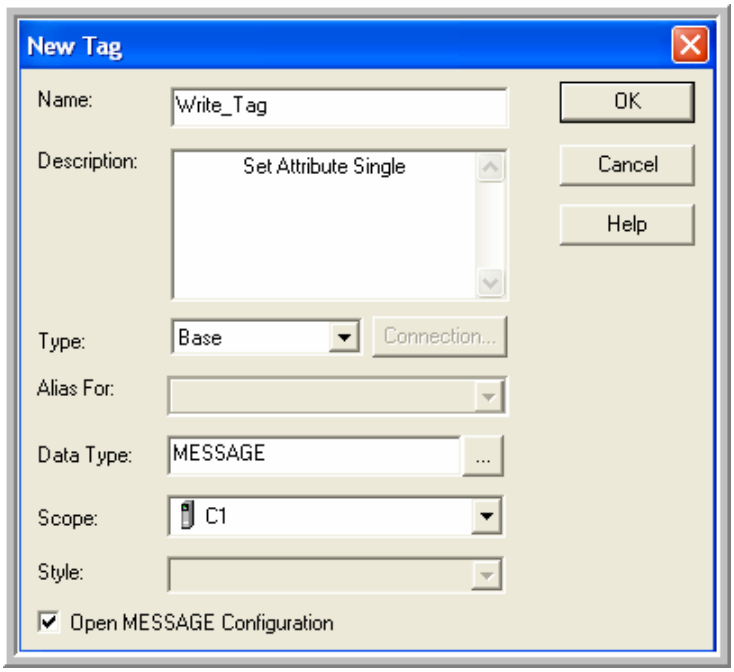
- Create a controller tag associated with Set_Attribute_Single message instruction.

Figure 48: Create a controller tag



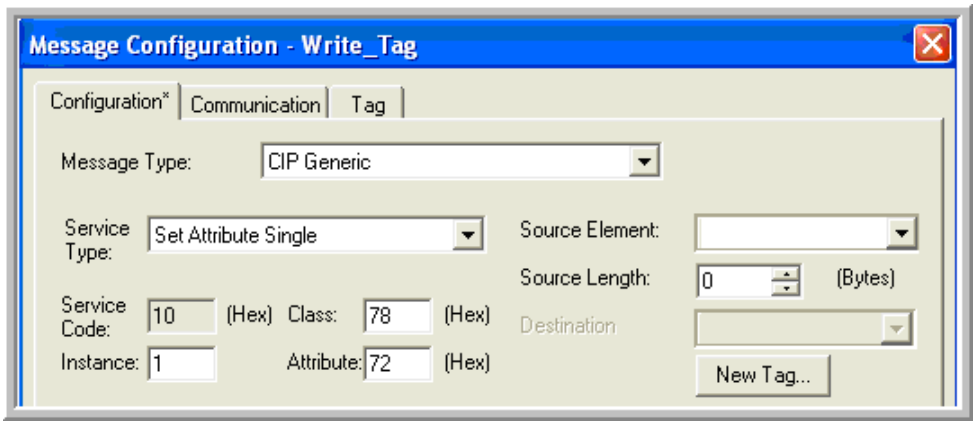
- Enter a tag name, select data type "Message" and check "Open MESSAGE Configuration" box

Figure 49: Configure "WRITE_TAG" message



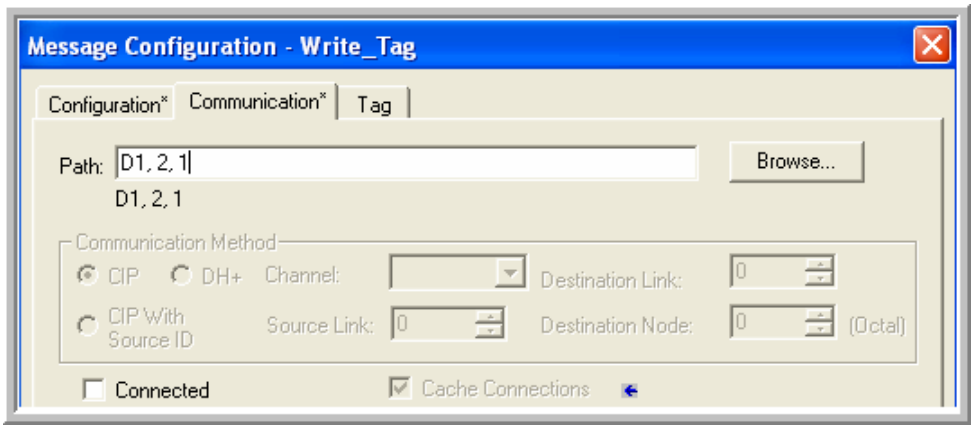
- Configure message as follows:

Figure 50: Message Configuration - Write_Tag



- Open communication page and define path
- Do not check "Connected" checkbox.

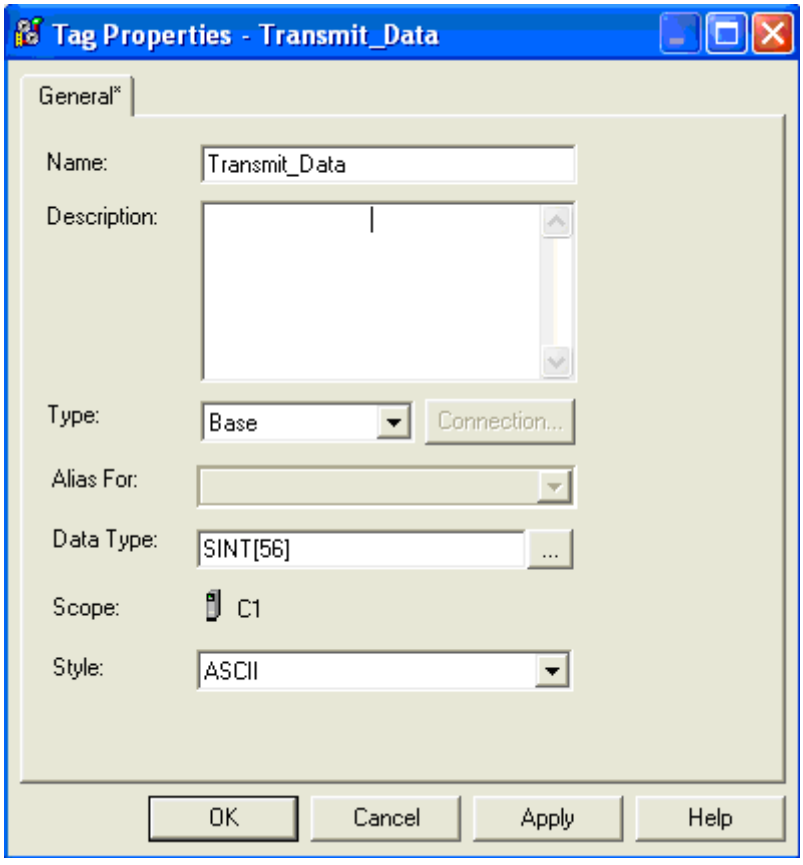
Figure 51: Message Configuration - Communication



Step 5 - Configure Transmit Tag

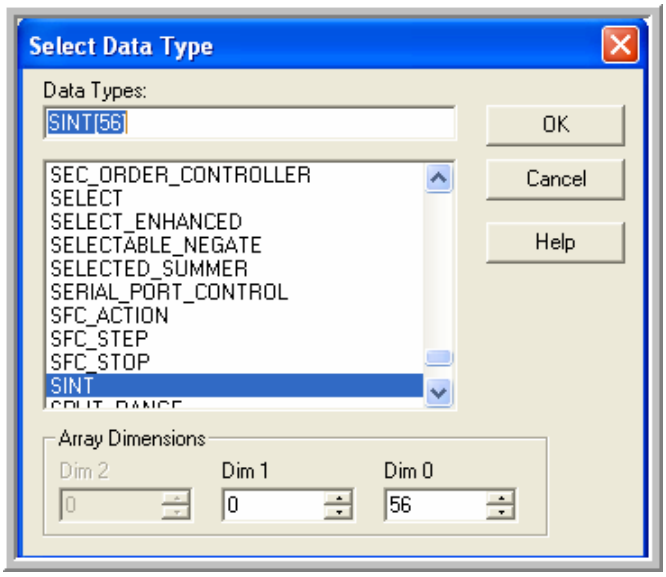
- Enter name, select the data format in the "Data Type" field as SINT and press ... button

Figure 52: Configure transmit tag



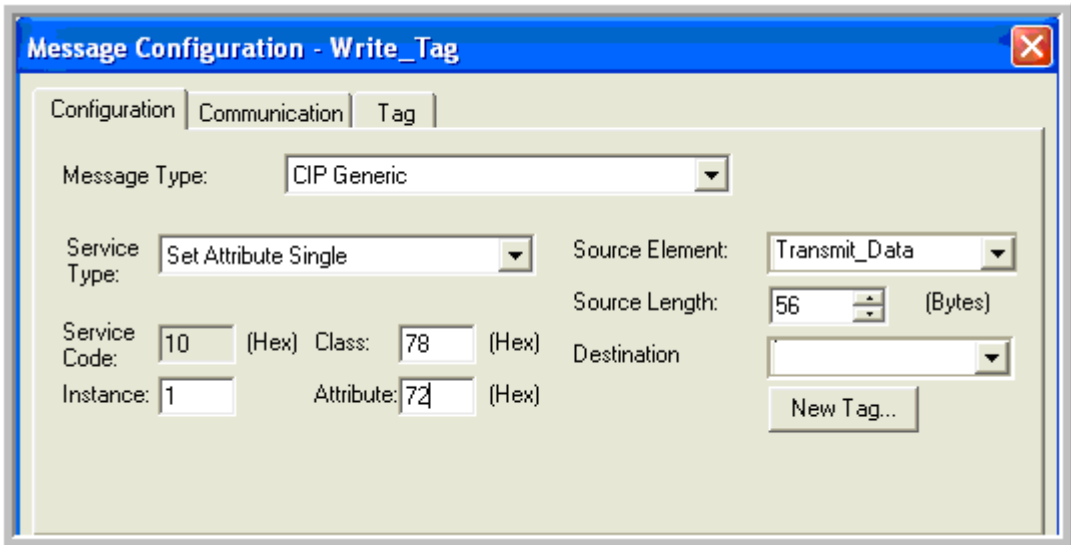
- Enter the data length 56 into "Dim 0" field and hit OK:
  - 6 bytes, the RFID tag header
  - + 50 bytes, the RFID tag data

Figure 53: Select data type



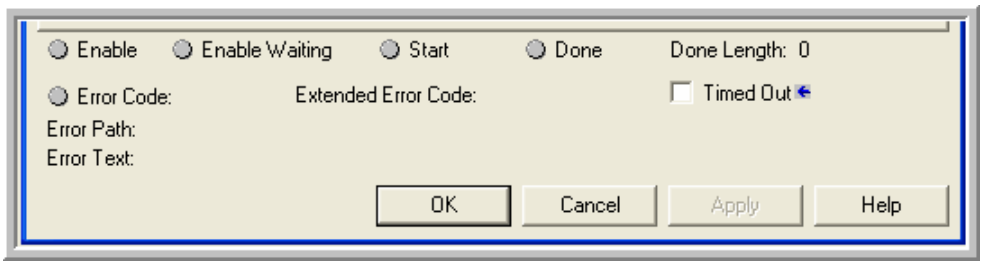
- Enter source element name and data size in the Configuration page:

Figure 54: Message Configuration - Write_Tag



- Press Apply and/or OK buttons

Figure 55: Apply and/or OK

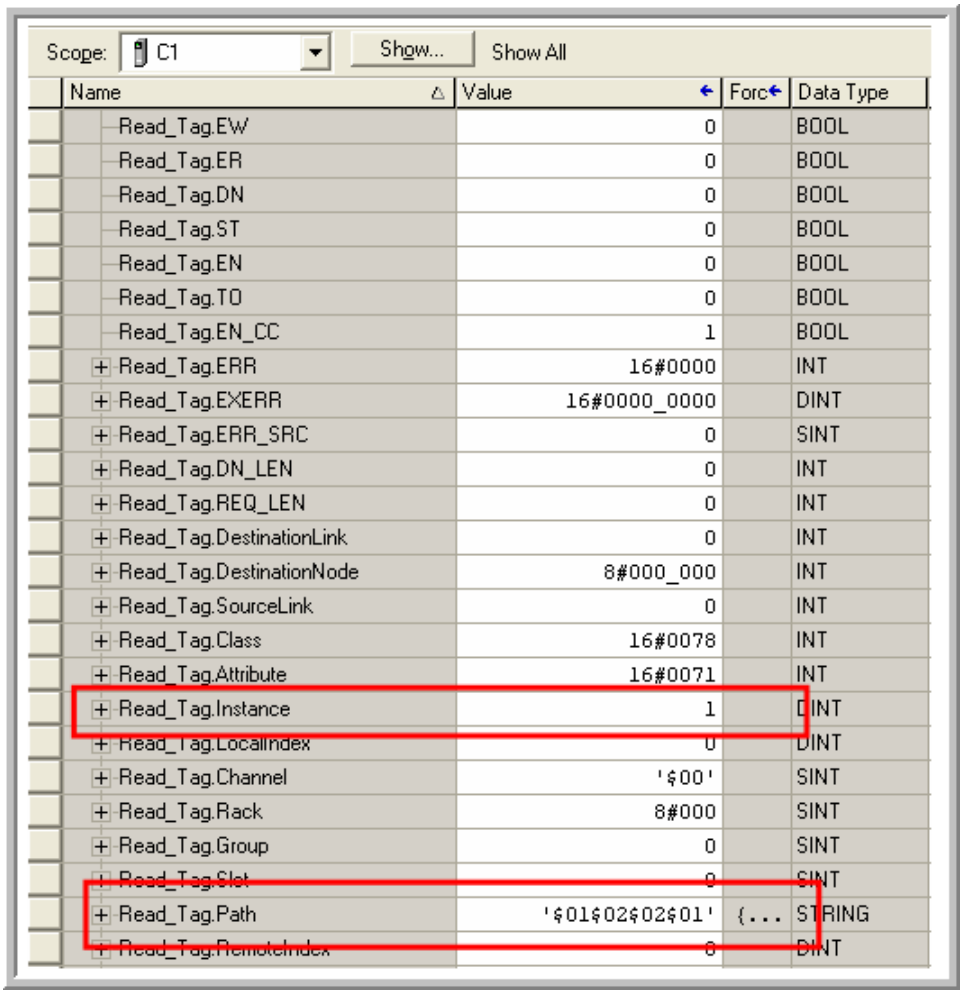


Managing CIP Data

The message instructions "Read_Tag" and "Write_Tag" are configured to read/write channel 1 data only. Use program control to modify the content of the message instructions as follows:

- To read/write data from other channels, modify the content of :
  - Read_Tag.Instance" in range {1..8}
  - Write_Tag.Instance" in range {1..8}
- To read/write data from other *BL ident* nodes, modify the node address in string content of:
  - Read_Tag.Path" as `$01$02$02$XX` where xx = {1..61} is *BL ident* node address
  - Write_Tag.Path" as `$01$02$02$XX` where xx = {1..61} is *BL ident* node address

Figure 56: Managing CIP Data



7 Appendix

AB Scanner Mapping Resources **2**

BL67 Gateway Status Register **3**

BL67 Gateway Control Register **5**

RFID Command Codes **6**

Command codes examples 7

RFID Error Codes **8**

AB Scanner Mapping Resources

Table 32: AB Scanner Mapping Resources

PLC / PC platforms	Scanner Type	Major rev	Mapping Region	IO map (words)	
				Input Data	Output Data
ControlLogix	1756-DNB	7.xx		248	246
CompactLogix	1769-SDN	2.xx		180	180
MicroLogix	1769-SDN	2.xx		180	180
FlexLogix	1788-DNBO	2.xx		248	246
SoftLogix5800	1784-CPCIDS	2.xx		1024	1024
SoftLogix5800	1784-PCIDS	3.xx		1024	1024
E/IP to Dnet Gway	1788-EN2DN	2.xx		248	246
SLC-500	1747-SDN/B	6.xx	Discrete	31	31
			M File	150	150
PLC-5	1771-SDN/C	6.xx	Block XRef 57	57	57
			Block XRef 58	58	58
			Block XRef 59	59	59
			Block XRef 60	60	60
			Block XRef 61	61	61
			Block XRef 62	62	62

BL67 Gateway Status Register

The first two bytes of every I/O message transmitted by the gateway are reserved for the gateway status. The first byte of the status word represents a Message Register that provides message and error codes in hex format. The second byte of the status word provides hardware diagnostic on a bit level.

Table 33: BL67 Gateway Status Register

Low Status Byte	Description	Meaning
B7-B0	**Status Byte**	**When set it provides error codes**
0x00	Message is OK	
0x01 – 0x0F	Reserved	
0x10	Additional explicit connection is established	At least one Explicit Message connection is established with another slave device.
0x11 – 0x1F	Reserved	
0x20	Module ID is unknown	At least one BL67 module is unknown. It is neither represented by an existing Vendor Specific Class, nor listed in the EDS file. Nevertheless, the module takes part in the process data exchange.
0x21 – 0xCF	Reserved	
Error codes		
0xD0	DupMacID[1] error	DupMacID check failed. Multiple nodes have the same address.
0xD1	MacID error	MacID error – Node address is > 63.
0xD2	Baud rate not permitted	Baud Rate set by DIP switches is not permissible.
0xD3 – 0xDF	Reserved	
0xE0	EEPROM[A)] error	Internal memory error – replace Gateway.
0xE1	Rotary/DIP switch error[A)]	Replace Gateway.
0xE2	ROM/flash CRC error[A)]	Replace Gateway.
0xE3 – 0xEF	Reserved	
0xF0	CNFG modification in progress	Gateway configuration is being modified.
0xF1 – 0xFE	Reserved	
0xFF	Command execution error	An error occurred while a command was being executed. The command will not be carried out.

A *Information can only be read by I/O-ASSISTANT.*

High Status Byte	Description	Meaning
B15-B8	**Diagnostic Byte**	**When set it indicates that:**
B8	Outputs not processing	BL67 is not configured: scanner is in idle state, initial I/O configuration has changed (e.g. module removed).
B9	Module list warning	Initial I/O configuration has changed: module removed or added to empty pre-configured slot.
B10	Local force mode	Force mode of I/O-ASSISTANT is active. I/O-ASSISTANT controls outputs.
B11	Module diagnostics	At least one module has a diagnostic message. Use I/O-ASSISTANT to resolve or search Device Parameters for a module diagnostics.
B12	No DeviceNet power[1]	No network power at Gateway DeviceNet connector.
B13	Module list error	Gateway module list has been modified. At least one module has been replaced with a different part number.
B14	Internal bus fault	Hardware error. Internal bus communication interrupted.
B15	CMD confirmation	This bit reflects the Activate Command bit of the Control Word. The execution of a command from the Command Register (Control Word) is confirmed by setting this bit.

A *Information can only be read by I/O-ASSISTANT.*

BL67 Gateway Control Register

GW Control Register is always set to 0 during normal operation. The list of available commands is listed in the following table:

Table 34: BL67 Gateway Control Register

Low Byte	Description	Meaning
B7 – B0		
Command codes		
0x00	Abort Command	A pending command is aborted; no other command is given.
0x01 – 0x7F	Reserved	
0x80	Force Outputs to OFF	Output of Consumed Data is stopped. Outputs are no longer operated via I/O connection; outputs are switched off. Reset gateway or send Force Output Processing command to resume output operation.
0x81	Force Outputs to Fault	Output of Consumed Data is stopped. Outputs are no longer operated via I/O connection; outputs are switched to substitute fault states. Reset gateway or send Force Output Processing command to resume output operation.
0x82	Force Outputs to Hold	Output of Consumed Data is stopped. Outputs are no longer operated via I/O connection; outputs are retained in current state. Reset gateway or send Force Output Processing command to resume output operation.
0x83	Force Output Processing	Resume output operation.
0x84 – 0xEF	Reserved	
0xF0	Module Bus Shutdown	Data transmission over local bus is stopped. I/O modules will be set according to their parameterization.
0xF1	Restart Module Bus	Resume data transmission over local bus.
0xF2 – 0xFF	Reserved	
High Byte		
B14 – B8	Reserved	
B15	Activate Command	Execute command specified in Command Register.

RFID Command Codes

Table 35: RFID Command Codes

Code	Function	Required Command Interface WORD size	BYTE[..] Data Interpretation	Description
0	<idle state>	1		Idle
1	READ TAG DATA	3	CmdVersCode, Channels, AddrL, AddrH, LengthL, LengthH	Read *LengthL/H* bytes of data from tag starting from *AddrL/H*
2	WRITE TAG DATA	3 +n	CmdVersCode, Channels, AddrL, AddrH, **[** LengthL, LengthH **]** Data[..]	Write *LengthL/H* bytes of data to tag starting from *AddrL/H*. Word *LengthL/H* is not mapped using CIP, resp. Expl. Msgs. Using CIP, the *LengthL/H* is dermined by the total length of the message.
3	ABORT COMMAND	1	CmdVersCode, Channels	Cancel pending command for the indicated channel.
4	RESET CHANNEL	1	CmdVersCode, Channels	Reset tag channel.
5	FILL TAG	4	CmdVersCode, Channels, AddrL, AddrH, LengthL, LengthH FillDataByte	Fill *LengthL/H* bytes of tag data area starting from *AddrL/H* with *FillDataByte*
6	EXTENDED SERVICE PRIMITIVE	2 +n	CmdVersCode, Channels, {SERVICE PRIMITIVE DATA}	Issues native RFID module/transceiver commands. Detailed knowledge of supported RFID command set and data mapping is required.
7	CLEAR ERRORS	1	CmdVersCode, Channels	Clears error messages.
8-15	Reserved			Reserved for future use

Command codes examples

Table 36: Command codes examples

CHAN-NEL	IDLE	READ TAG	COS TAG	WRITE TAG	ABORT CMD	RESET CHANNEL	FILL TAG	CLEAR ERRORS
1	0x100	0x101	0x1100	0x102	0x103	0x104	0x105	0x107
2	0x200	0x201	0x2200	0x202	0x203	0x204	0x205	
3	0x300	0x301	0x3300	0x302	0x303	0x304		
4	0x400	0x401	0x4400	0x402	0x403			
5	0x500	0x501	0x5500	0x502				
6	0x600	0x601	0x6600					
7	0x700	0x701						
8	0x800							

RFID Error Codes

Table 37: RFID Error Codes

Error code	Name	Description
0	OK	No error occurred, idle
1	PROCESSING CMD	A command was issued, accepted and processing is not finished yet. This is not an error, but a busy indication.
2	COMMAND VERSION NOT SUPPORTED	A command version > 0 was defined. Currently version 0 is supported only.
3	CHANNEL ALREADY BUSY	Aborting a command was not finished while a new one is issued.
4	CHANNEL NOT PRESENT	Channel (“module”) is not present. Two channels per module are supported. Four RFID modules max.
5	CHANNEL NOT INITIALIZED	Gateway could not initialize the RFID module state machine. The channel cannot be used. The channels are initialized automatically. If explicit command RESET CHANNEL fails bringing up this error, it might be caused by hardware problems.
6	CHANNEL ACCESS TIMEOUT	RFID channel state machine does not respond. Might be caused by hardware problems.
7	UNKNOWN COMMAND	Command issued is not supported
8	COMMAND EXEC ERROR	Error occurred while processing a command. (E. g., a TAG, brought into reception area, vanished before command could be finished)
9	INSUFFICIENT DATA	The amount of data given is not sufficient to process the command.
10	<reserved>	
11	<reserved>	
12	<reserved>	
13	<reserved>	
14	<reserved>	
15	<reserved>	

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